MECHANICAL ENGINEERING

· JANUARY 1949 ·

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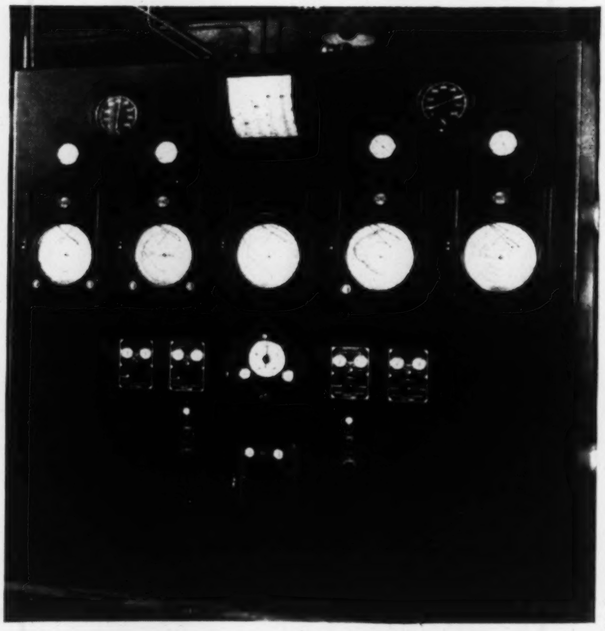

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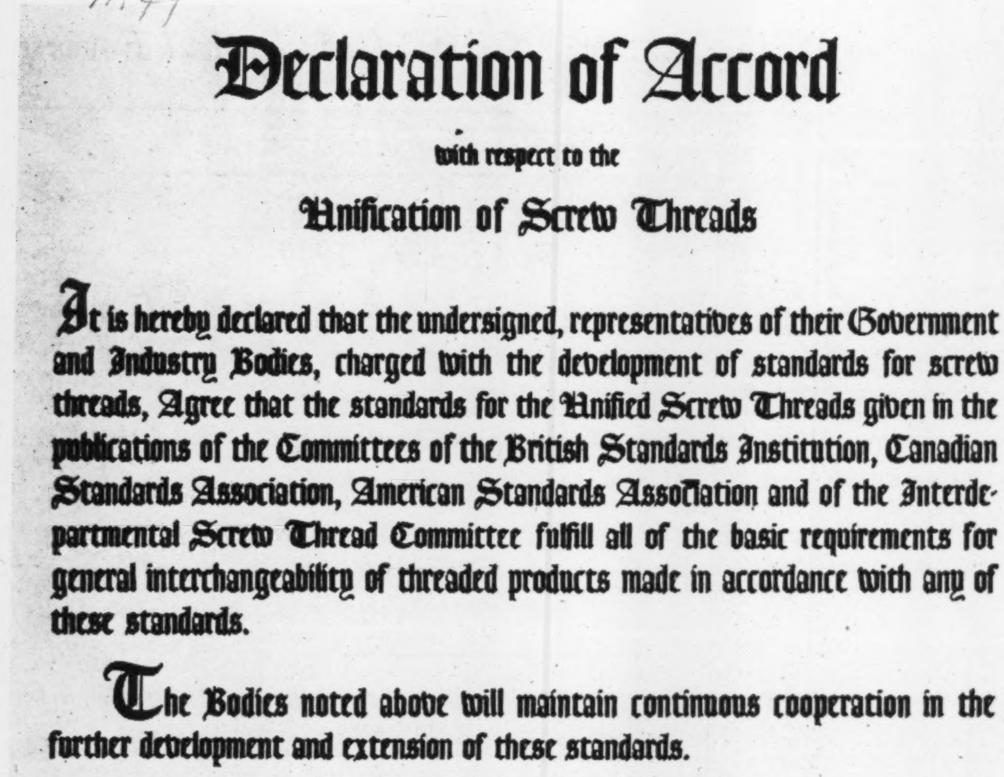

Declaration of Accord

with respect to the

Unification of Screw Threads

It is hereby declared that the undersigned, representatives of their Government and Industry Bodies, charged with the development of standards for screw threads, Agree that the standards for the Unified Screw Threads given in the publications of the Committees of the British Standards Institution, Canadian Standards Association, American Standards Association and of the Interdepartmental Screw Thread Committee fulfill all of the basic requirements for general interchangeability of threaded products made in accordance with any of these standards.

The Bodies noted above will maintain continuous cooperation in the further development and extension of these standards.

Signed in Washington, D. C., this 18th day of November, 1948, at the National Bureau of Standards of the United States.

C. D. Howe	Ministry of Trade and Commerce, Dominion of Canada
J. G. Morrow	Canadian Standards Association
T. R. B. Sanders.	Ministry of Supply, United Kingdom
Percy Good	British Standards Institution
Ernest Smith	Representative of British Industry
E. U. Condon	National Bureau of Standards U. S. Department of Commerce Interdepartmental Screw Thread Committee
[illegible] P. [illegible]	American Standards Association The American Society of Mechanical Engineers Society of Automotive Engineers
William L. Batt	Sponsors Council of United States and United Kingdom on the Unification of Screw Threads

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MECHANICAL
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1949

GEORGE A. STETSON, *Editor*

Screw-Thread Unification

ON the opposite page is reproduced a facsimile of the accord which affirms an agreement for the unification of the American and British systems of screw-thread standards, signed on Nov. 18, 1948, at the National Bureau of Standards, Washington, D. C., by representatives of government and industry of Canada, the United Kingdom, and the United States.

The significance of the agreement will not be lost on engineers and manufacturers. It is well known that screw-thread forms used in the United Kingdom and the United States have had their similarities and essential differences, and that it is these differences that have been the cause of much inconvenience and waste. In the United Kingdom the Whitworth thread has been used since 1845. Its characteristics are a 55-deg angle with rounded crests and roots. In the United States the angle of 60 deg has been used, and crests and roots are flat. This American Sellers thread was adopted in 1864. In accordance with the agreement the 60-deg thread angle has been adopted as the common form, and the rounded root of the Whitworth thread has been agreed upon. It is pointed out by experts that, practically speaking, the U. S. Standard thread cut by a worn tap closely approximates the rounded root form, so that changes necessary in putting the new standard into effect will be a minimum in the United States. Thread crests may be either flat or rounded. The compromises effected by the signing of the agreement make nuts and bolts manufactured in the three countries under the unified standard completely interchangeable.

It was during World War II that the waste of time and money and the inconvenience caused by two thread forms used by nations united in a common effort provided the impetus to settle once and for all upon some compromise which would permit the desired interchangeability. Almost every manufacturer can provide from his own experience some examples of this waste and inconvenience; and manufacturers who supply machinery and parts for export, as well as users of equipment manufactured in the countries where the Whitworth thread has been the accepted standard, will welcome the new standard. Some of the delays and costs are quoted in almost astronomical figures. Surely common sense and a realization of the needs of a common defense in the event of future wars demanded the unification effected in the recently signed agreement.

Members of The American Society of Mechanical Engineers can be proud of the part played by the Society in this important standardization project, which has been hailed as the culmination of 30 years of effort among the three nations. Subcommittee No. 1, ASA Sectional Committee, charged with the revision of ASA B1.1—1935 American Screw Threads and with embodying therein the unified screw threads, was organized under the procedure of the American Standards Association and was sponsored by The American Society of Mechanical Engineers and the Society of Automotive Engineers.

According to a statement issued by the National Bureau of Standards, the Unified Screw Thread Standard was formulated in five major and several informal conferences of representatives of the countries concerned. In July, 1918, the Congress of the United States authorized the appointment of the National Screw Thread Commission, with the director of the Bureau as chairman, to investigate and promulgate standards for screw threads. One year later the Commission conferred with British and French engineers and manufacturers of screw-thread products for the purpose of discussing the tentative report it had prepared with the hope that it might serve as a basis for international standardization. No definite agreements were reached, but the need for continued study was recognized.

In 1926 a further attempt was made to unify the British Standard Whitworth Thread and the American National Thread when a British mission visited the United States and proposed a basic thread angle of $57^{1}/_{2}$ deg. The compromise was not acceptable.

In 1943 a British mission visited the United States, at the invitation of the Combined Production and Resources Board, and Canadian representatives were also invited to participate in the discussions, in which notable progress was made on projects of immediate concern. In August–September, 1944, a joint United States–Canadian group, sent to London by the same Board, conferred with committees of the British Standards Institution.

In September–October, 1945, under the auspices of the same Board, a Conference on Unification of Engineering Standards was held in Ottawa, Canada. At this Conference a unified form of thread having a 60-deg angle, together with standard sizes and pitches, was agreed upon. The foundation was thus laid for the standards to be agreed upon, but a vast amount of work remained to be done in developing and agreeing on grades of fit and corresponding classes of tolerances and allowances. When a British delegation visited the United States in July, 1948, basic mathematical formulas for such tolerances and allowances were tentatively agreed upon and later ratified by correspondence, thus making possible the completion of the standards agreed upon at the Nov. 18, 1948, meeting.

The accord marks the beginning of the realization of unification. Purchases by the three governments will be based on the new standards, but industrial use within the normal commerce of the nations will require a transformation of industrial practices. Such a change will take time, but all American manufacturers are urged to effect the change as quickly as possible. It is expected that new tables will be available for use within the matter of a few weeks—a few months at the outside.

Reason for RESA

As announced in the news section of this issue, RESA, the Scientific Research Society of America, was launched at Cleveland on Nov. 27, 1948, at a convention which immediately followed the 49th annual convention of the Society of the Sigma Xi.

The object of RESA is to "encourage original investigation in science, pure and applied." The fields represented are mathematics, physics, astronomy, sciences of the earth, biology in its various branches including psychology, anthropology, medicine in its various branches, and engineering in its various branches. According to the by-laws the following activities are among those recognized as appropriate to the fulfillment of the object of RESA: "the election to membership in the Society of members of the staff of research institutions, students and members of the faculty of educational institutions, and others who have fulfilled the requirements of membership; the maintenance of companionship among investigators in the various fields of science; the holding of meetings for the discussion of scientific subjects; the preparation and distribution of periodicals and other publications devoted primarily to the dissemination of scientific information, particularly the results of research; the encouragement of research in science through financial support by grants-in-aid; and the maintenance of national lectureships."

The formation of RESA marks a significant milestone in the progress of Sigma Xi and in scientific research, particularly in the hundreds of industrial and institutional research laboratories of the United States. Learned societies have an honorable tradition. Men of science have organized such societies ever since 1560 when Della Porta founded in Naples the Academia Secretorium Naturae. Della Porta was called to Rome to defend himself against charges of "magic and sorcery" and was obliged to abandon his academy. But the seventeenth century saw the formation of scientific societies in England and France, and in 1743 Benjamin Franklin founded the American Philosophical Society in the New World.

Since Della Porta's time science has become respectable and scientific societies have proliferated in the Western World, where there is today no fear of interference by church or state in the pursuit of their activities. This is a precious heritage which men of science must guard jealously by guarding the liberties of an individual in a democracy, for where men are free, science is free.

With the multiplicity of scientific and related societies in existence today it is natural to inquire: Why RESA? A partial answer to this question was given on these pages in our September issue, and the substance of that explanation will be found in the account of the first RESA convention reported in the news section of this issue, if it has not been made clear by the object and proposed activities already quoted.

The Society of the Sigma Xi was founded at Cornell University in 1886. It has always been essentially a scientific honorary society operating principally in the colleges and universities. Of its 55,000 members about one half are active as members of the approximately 100 chapters, which can elect members and associate members, of the fifty odd Sigma Xi clubs, which cannot elect members, or they belong to a small dues-paying group of "alumni" who constitute the membership at large. About 4800 new members and associate members were elected by the chapters in 1948.

During these years of growth in membership and in prestige, scientific research expanded from the educational institutions, where it had its origin, into industrial, governmental, and nonacademic research laboratories where today vast numbers of scientists and engineers are engaged. Until RESA was organized, unless members of Sigma Xi were associated with institutions where there were active chapters or clubs, no means existed whereby scientists could enjoy the benefits of organized association with other research workers in their communities. Unless scientists and engineers were engaged in research at institutions where chapters existed, no means existed of their becoming members of Sigma Xi, although they might become local members of Sigma Xi clubs. RESA was organized to afford the opportunity for the formation, in a research laboratory of an institution—industrial, governmental, academic, or nonacademic—or in a community where several research laboratories exist, of clubs or branches of the Scientific Research Society of America. Branches will be able to honor achievement by election to membership and to encourage achievement by election to associate membership. Clubs and branches of RESA may include in their membership all scientists and engineers worthy of this distinction and association. As companions in research, members can emerge from the "iron curtains" that surround the specialized fields in which each labors and benefit from the cross-fertilization of ideas and from the association of kindred spirits that result from a discussion of a wide range of scientific and technical subjects. And through the organized activities of a national organization they can make significant and useful contributions to the advancement of science and the aid of fellow scientists throughout the nation.

There should be generated by the growth of RESA a sense of unity and of purpose among the scientists and engineers of the nation which will bind them together in a common cause for their own benefit and in the service of their fellow men. If these hopes are realized, that fulfillment will constitute the reason for RESA.

ENGINEERING OPPORTUNITIES *in* INDUSTRY

By E. G. BAILEY

PRESIDENT 1948, THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

FORCES IN NATURE

MAN lived on this earth a long time with almost no conception or appreciation of the natural forces available and the resources obtainable for his benefit. Man finally utilized the wind for sailing ships and for turning windmills to pump water and grind meal from grain. Much later, waterfalls in small streams were crudely harnessed for power. The growth of vegetable and animal food was accepted with but little appreciation of its dependence on the tremendous energy continually coming from the sun or the very great potential usefulness of this energy.

Through science, engineering, and industry man has, in a relatively short time, learned much about how he can better utilize many of the available forces and resources of Nature. He has greatly augmented the energy available to him through the use of fuels. Many tools, goods, and services have been made possible through the recovery and processing of mineral and vegetable products. We have attained what we sometimes call a "high standard of living."

FORCES IN HUMAN RELATIONS

In the realm of human relations man seems to have followed a similar course, but for some reason he has not been able to progress to an equivalent stage of development. There seem always to have been forces reacting between people which resulted in friendship, love, distrust, hate, amusement, boredom, co-operation, and strife.

Most psychologists say that human nature has changed but little, if any, since early history. Philosophy, education, religion, and civic organizations have made deplorably slow progress in promoting happiness and peace for mankind, while invention in chemical and mechanical development—so useful in bettering our temporal needs—has been used to fashion tools for destruction when suspicion, hatred, and selfishness have caused outbursts of war.

Certainly we have learned beyond the shadow of doubt that such outbursts between men transcend in importance any damage from the storms of Nature and the resultant cost to all concerned. In early wars there were usually a vanquished and a victor; and although the latter acquired some land, property, or rights, today everyone loses—some possibly more than others—and a net loss is inevitable.

There must be a course which can be followed to lead us away from the darkness and savagery of hatred and war to good will among men, just as there is one, in science and engineering, along which we have progressed from the tragedy of famine and starvation, the wretchedness of disease, and the drudgery of human labor.

INDUSTRY AND HUMAN RELATIONS

While it is not possible for any one group to accomplish miracles, it is firmly believed that engineers and industrialists have made a real start toward improving human relations. With the co-operative help of all others, they can accomplish relatively as much in the field of good will among men as has been accomplished in supplying increased varieties and quantities of goods and services, by utilizing the forces and resources of Nature.

Many will be skeptical of even the suggestion that leadership in this direction can come from engineers and industrialists, but it is an accomplished fact in many individual companies and corporations today. The managements of these companies have been building quietly, but firmly and convincingly, an excellent relationship between themselves, their employees, their customers, their stockholders, and the community. Such companies exist in many different industries. They progressed to this status because of real ability and leadership, without fanfare or great publicity. What has already been done can be repeated extensively, until the great majority of all industry fits into this pattern, at which time the accomplishments will be unbelievably good.

COMPANY ORGANIZATION AND MANAGEMENT

Most industrial companies began as small units with very little capital. The application of hydro and steam power to textiles came early in the Industrial Revolution. Blast furnaces, mines, and the like were started and developed as individual enterprises, usually with owner management. Many such companies were well run with satisfactory relations between management, employees, customers, and the community. In time, many failed; many were combined by entrepreneurs, financiers, and others into trusts; a few carried through as individual companies with inherited family ownership, or gradually distributed ownership to the stockholding public.

Some individually owned and controlled companies are still originated from time to time, and their products are usually based on invention or engineering knowledge. But, on the other hand, many large companies today have more individual stockholders than they have employees.

A major change has taken place in the kind of management. It is now largely in the hands of competent men who have worked up within the industry and generally within the individual company. While the president or chief management officer is employed by and reports to a board of directors, nominally chosen by the stockholders, the management usually selects the nominees for directorships and, in fact, runs the company. There is every reason why such self-propagating management should exist and continue as long as it is good and is satisfactory to the stockholders. This type of management will undoubtedly prove best in the long run in comparison with any previous form of manager-owner-employee relationship.

The credit for the functioning or operation of any company should be shared with the entire personnel of the organization

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Presidential address delivered at the Annual Dinner and Honors Night of the Annual Meeting, New York, N. Y., December 1, 1948, of The American Society of Mechanical Engineers.

when the total results are satisfactory. Such results can be obtained only if there is good co-operation on the part of the entire group. If a company is in trouble and doing badly, the cause rests solely at the top, because top management alone is responsible for the selection, training, co-ordinating, and supervision of employees and staff.

Good management results in a healthy, prosperous, and self-perpetuating organization. Proper selection, training, and co-ordination of the personnel meet the problem of succession from within, and such management is deserving of the confidence of the stockholders. If things start going badly, the situation is usually detected through the customers, the employees, or the balance sheet, and sometimes through all. Then, either the directors or the stockholders step in and change the management, and sometimes the directors as well. Any stockholder may sell his interest and invest with a better company.

Industrial organizations run on the basis of "managerial enterprise" seem to be the result of the evolution of good business and democracy, which have developed largely in the United States. This type of industrial organization will survive against all odds if we can realize the importance of properly training our young men to meet its opportunities and demands. Such training should start in the home and the church and continue through high school, college, and industry.

ENGINEERING PROVIDES PRODUCTS AND PROCESSES

However good the management and organization of a company may be, it must market a product which can be used with satisfaction by those who purchase it.

Most companies were originally formed to produce a commodity or service which evolved from a new invention, or was the outgrowth of an engineering development for which there was felt to be a need. Regardless of whether a company produces typewriters, locomotives, nails, blast furnaces, chemicals, or automobiles, or provides services, such as electric power, transportation, and communications, the duty of its management is to see that the product or the service is kept up to date and is fairly competitive. Stagnation tends to lose customers and destroy the morale of the organization. The methods of manufacture also must be under continuous study to maintain or improve quality at minimum costs.

Both of these steps are largely engineering problems, and decisions must be made continuously as to when to do this or to do that, as there are always alternatives to consider. The timing of changes is important, because most changes should be made frequently enough to keep the enterprise up to date, but not so often as to impose unwarranted financial burdens.

The product is the lifeblood of a company. It must be kept healthy and be a source of pride and inspiration to every employee in the organization.

ENGINEERS CAN CONTRIBUTE TOWARD ESTABLISHING POLICIES, HUMAN RELATIONS, AND PUBLIC RELATIONS

There has been a tendency to look upon engineers as fitted only for association with the drafting board, slide rule, and the machine shop. Perhaps it is true that engineers have frequently failed to express opinions on subjects other than those of an engineering nature, but this has not been due to any inability on their part to analyze and logically interpret the factors involved. As in almost any other walk of life, all that is necessary is the courage to inject oneself into whatever the problem may be and to express good, wholesome, logical thinking. The engineer's approach in his everyday work fits him admirably for this form of realistic analysis of problems, regardless of their source. Possibly he has been too reticent.

People admire machinery when they see it, and they would like to know more about the design, make, and operation of the tools and services of our civilization, as well as the men and methods involved in its production. Engineers should realize that basic engineering principles can be used to illustrate facts of human relationship and interest as a forceful and pertinent supplement to other interpretations more frequently heard from the pulpit and lecture platforms.

Engineers are human, and with proper interest and thought in such activities they can hold their own with others in planning policies and solving the problems of human and public relations. Many of the best executives in industry today are engineers who have educated themselves in human behavior and public interests.

THE FUTURE FOR ENGINEERING AND INDUSTRY

Invention preceded industry. Industry preceded the engineering profession. Engineers traveled at a very fast pace to develop the many laborsaving devices by means of which it has been possible to provide the so-called necessities of life in abundance. They then forged beyond and made available many goods and services that are classed as conveniences and luxuries. People continue to want all they have and more, expecting their desires to be supplied in profusion with fewer and fewer man-hours of labor from the perpetual fountain called Industry.

Let us take stock of our present situation. The sequence of events has completely reversed. Now, engineering must plan further improvements in industry. Industry must plan and finance research. Research today must work hard and spend much time and money to make a really worth-while invention or improvement in almost any line of engineering.

This is not a pessimistic note about running out of new developments; it is a realistic statement to the effect that you can't pick a Yale lock with a hairpin.

Research has paid well, but there is an ever-increasing need for good judgment in selecting projects for research and the manner in which the work should be conducted. Even better judgment is needed to make decisions about carrying the result of a given research into a full-scale development and its commercialization. There are some recent illustrations in one of the oldest branches of the engineering profession—bridge building—where new advancements in the use of alloy cables and certain design features purported to save weight and reduce costs ended in failure, tragedy, and unanticipated costs.

There seems to be an urge not only to gamble heavily that we are going to cash in on many spectacular dreams but also to publish confusing statements well in advance of experimental work and actually fool the unsuspecting public, some people in industry, and a few in other branches of engineering.

Many of our new projects are likely to come more slowly and more expensively than we expected. We might better use a little greater margin of safety in depending on new ideas; at least we should not spend the savings until they are realized.

Can we continue to keep the net costs of production in line through continued improvement in equipment and methods? The over-all record to date is very good as it applies to all kinds of laborsaving devices. They have without exception paid handsome dividends on the investment and, contrary to some views, have not resulted in over-all unemployment. In handling earth in excavation work we have gone from a one-ton to a 10-ton truck, and now to a piece of equipment with a capacity of 45 tons; but it is unlikely that we can keep on increasing capacity and economically haul 2000 tons in a single load. We must, sooner or later, face the inevitable law of diminishing returns. Most, if not all, developments follow the typical growth curve which begins with a relatively low rate of increase, gradually becomes steeper and steeper until the optimum rate of change is reached, and finally flattens out and indicates the economic maximum for a given set of conditions.

The most dangerous period in any cycle of active development is at the time when a great deal has already been accomplished and one takes time out to brag about it. One may somehow be lulled into the thought that additional improvements will be automatically forthcoming—they will not. In our present competitive system others may be incited to carry on and make further improvements in the same or related fields.

Oftentimes some other improvement in a different but related branch of the problem may result in a new growth curve superimposed on the original, and still higher attainment becomes possible.

TOP MANAGEMENT FOR THE FUTURE

It may be well to clarify the point that industry is only that part of business which produces goods and services. It is to be distinguished from trade and commerce where goods are bought and sold.

Industry of the future will require more of the engineering type of planning, and many decisions can be properly made only with a relatively complete knowledge of the engineering, economic, and human-relations phases of the problems in an ever-changing and increasingly complicated set of conditions. Top management should have a good foundation of fundamentals and a long and realistic contact with gradually increasing responsibilities in the specific branch of industry to be followed.

It would seem to be entirely impossible for a socialized society to meet the requirements here set forth. To offset the world-wide trend toward socialism and communism, it behooves industry to proceed along the path which is now being followed by the best companies, and even they should make further improvements in every facet and branch of their individual activities as fast as possible. The strength of an oak comes only from within itself, even when nurtured in favorable environment.

TRAINING ENGINEERS FOR INDUSTRY

On the basis of this brief résumé of the present and probable future place of industry in our civilization, we see that engineering is in a position to play an increasingly important part.

Where shall industry obtain its recruits, and what preliminary education and training should they have?

What is industry's obligation to the educational institutions and their product—the graduate?

Most of the many thousands of engineering graduates now coming each year from our colleges are employed by industry. Industry also employs thousands of graduates besides engineers and promotes many employees within its organization who have no college training. Many of all groups acquire considerable knowledge in engineering practice. Likewise, many engineers acquire knowledge in fields of management, finance, human relations, and the like.

Since this postgraduate training in industry has been so fruitful in broadening many industrious and intelligent people into many lines of activity, is it really necessary for some of our engineering curricula to be modified to include an extra year of the so-called "broadening" courses? The best place to teach the fundamentals of engineering is in our accredited engineering schools. Let us concentrate on doing the best possible service in that field. Then let the individual graduate and his employer take over the problem of broadening and extending his education in the fields of management, administration, human relations, and even economics, as together they work in the laboratories of actual experience.

Industry must fit itself even better to continue and extend its training courses so that the graduate can develop his abilities and earn promotion and advancement in his profession and within the company. Some companies seem to do much better than others in giving their employees deserved opportunities and proper advancement. Some others by-pass personnel in the upper brackets, bringing in outsiders to the discouragement of well-deserving employees, who, in many cases, would have been more competent to assume greater responsibilities, had management itself been better able to judge ability and human values in this important area.

Every graduate of an engineering school should select his employer with great care, in addition to having the employer select him. Each man who enters a company has the right, and an obligation to himself, to learn the policy and record of his prospective employer as to the opportunities for training, recognition, and advancement. The healthy and better companies have an obligation to their present organization to bring in only those who seem to be best fitted to co-operate with the present team and aid in making it still better. Good management is self-propagating; poor management is self-destructive.

The relation between cause and effect in company policy and management is not always quickly noted. There may be a considerable time lag in accurately detecting either improvement or regression. Each person should be interested and should do his own thinking and make his own evaluation in this important part of our industrial world.

There seem to be unlimited opportunities in industry for good engineers for a long time to come.

UNFINISHED BUSINESS

Industry should better understand and diagnose its good and bad points.

It is the duty of industry to keep healthy and perpetuate itself as long as it can economically render a useful service to mankind.

It is incumbent upon industry to convince the public of its usefulness and integrity.

Industry must first learn and then teach its employees, its customers, and the public at large, many facts about fundamental economics, such as:

(*a*) Can we continue to reduce working hours and add to spending hours without want?

(*b*) Can we snitch a ride going uphill, when we are supposed to do the pushing?

(*c*) Is feather-bedding honest?

(*d*) Can we find any other source of wealth than working or stealing? Can we classify all acquisitions as being one or the other?

(*e*) When will we realize that many of our ills are self-inflicted?

SUMMARY

1 American industry is the greatest single factor in our present status.

2 Industry is better than we ourselves realize and much better than the public knows.

3 Industry can improve itself from within, and it welcomes sound and constructive advice and help from all professions and classes of people.

4 Industry now leads in serving the people in material goods and such services as power, transportation, and communications. It can and will co-operate with all loyal Americans to render still greater service in education, religion, arts, human relations, and civic responsibilities.

THE YOUNG ENGINEER

His Professional Growth and Development

By H. P. HAMMOND

DEAN OF ENGINEERING, THE PENNSYLVANIA STATE COLLEGE, STATE COLLEGE, PA. MEMBER ASME

THE Engineers' Council for Professional Development has the responsibility of aiding the young engineer in his professional development during the most formative period of his career: the ten years that extend from the middle of high school to the end of his "internship" in industry. It is during this period that he chooses his future occupation, lays the foundation for it in college, and passes through his orientation to active life as a practitioner. It is during this period, also, that he begins to form his concepts and ideals of professional conduct and assumes the responsibilities of family life and citizenship. It is a critical period for the young engineer as an individual and, through him, for the profession of which he is a member. During its existence ECPD has devoted its efforts steadily and, to a degree consistent with its form of organization, effectively, in the discharge of its mandate from the profession with respect to this period in the engineer's life. It has established means of aiding the high-school boy to choose his profession; it has set up criteria of quality of engineering education, and is now performing the same function in the auxiliary field of the technical institutes; it has formulated canons of ethical professional practice; and it has fostered means of aiding the young engineer to promote his own advancement and to form his concepts of the place and function of the engineering profession in the national social order as well as his own place in it. These responsibilities of ECPD are indeed broad and important. It is remarkable, I think, that it has accomplished so much toward their attainment in its relatively short life and through the purely voluntary efforts of its members.

This summary of ECPD's activities has been given to indicate the place that one of its functions has with respect to its program as a whole. I refer to the last of its phases, in point of time, that is, the development of the young engineer during his first years in practice. This is in many ways the most critical time in the engineer's adult career. The restraints and guidance of college have been removed; the performing of regular scholastic tasks is no longer required; and, unless he sets himself to the task of self-improvement more rigorously than is to be expected of most individuals, the young engineer no longer follows a rapidly ascending curve of mental development. For the first time in his life he becomes wholly dependent upon himself, not only to earn a livelihood, but also to carve out his career in the face of competition and of responsibilities to others than himself. In a large measure he is unprepared for the sudden change to a new type of environment and occupation. He can no longer measure his progress as it was plainly indicated to him in college; he may not see the "why," with respect to himself, of things he has to do. It is no wonder that his early years in industry have been called the period of the "postcollege slump." It is in this period that, I think, ECPD has its greatest opportunity for service to the individual engineer and through him to the profession, and at the same time is confronted with the task that is most difficult to bring within the scope of a clearly definable program. What follows is an effort to outline two major subdivisions in which the process of the self-development of the young engineer may be considered and of ways in which ECPD may assist in improving them. One of these relates to increasing his technical proficiency; the other to the development of his professional concepts and ideals as an engineer and as a citizen.

I ENGINEERING EDUCATION, A CONTINUING PROCESS

Engineering is the only major profession in which the four-year undergraduate curriculum continues to be the norm of professional education. Up to the present, at least, the movement to lengthen the undergraduate curriculum has not made rapid progress. This has significance with respect to what is to follow.

In 1947–1948, of about 237,000 undergraduate engineering students in the United States and Canada, only about six per cent were enrolled in five-year curricula; and half of these were in part-time co-operative curricula. That is, only about three per cent were pursuing undergraduate curricula of five-year content.

At the same time, it remains undeniably true that the total period of formal education of a considerable fraction of our engineering students must be increased if two aims are to be accomplished: (1) To give them both a more thorough and a broader command of fundamental scientific principles as well as an introduction to more advanced phases of the rapidly expanding scope of engineering, and (2) to broaden their horizons with respect to the social and economic implications of what they will do in later life. I call attention to the fact that I made this statement with respect to "a considerable fraction" of our students, but not to all of them. As technical education is now organized in this country, and in view of the great variety of purposes it serves as well as the interests and capabilities of its students, four years of a sound and rather general education combining scientific, technical, and humanistic elements are sufficient for most of our students. It is for the other fraction of our students, and a very substantial fraction, that a longer period of formal education is necessary. How to accomplish this is one of the great questions before the profession.

One direction that the solution of this problem may take is in the further growth and strengthening of postgraduate work. The statistics of postgraduate enrollments are encouraging in this respect though, on analysis, not as much so as they appear at first glance. In 1947–1948, in comparison with about 34,500 seniors there were about 14,200 postgraduate students of engineering, 12,600 enrolled at the master's level, and 1560 at the doctor's level. This is a ratio of nearly 40 per cent of postgraduates to seniors, and if enrollments alone pictured the situation, I, for one, would feel that engineering education at its upper levels was rather rapidly reaching quite a satisfactory condition in so far as the adoption of a longer curriculum is concerned.

The statistics of degrees conferred, however, show the situation differently. In 1947–1948 the number of bachelor's, mas-

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ter's, and doctor's degrees conferred in engineering were as follows:

Bachelors	19,134
Masters	3,141
Doctors	133

The total of advanced degrees was therefore but 17 per cent of the number of first degrees, and the number of doctor's degrees was but 0.7 per cent of the number of first degrees. It must also be remembered that whereas virtually all seniors are full-time students, only 40 per cent of graduate students carry full schedules. The remaining 60 per cent are divided about equally between part-time day students and evening students. This is stated merely as a fact and not as a criticism, for it is in part-time graduate work that the solution of the problem of the post-college scholastic training of the young engineer to a large extent appears to rest.

To sum up the present situation, while graduate work has been increasing, particularly during the period of subsidization of veterans, the bulk of our engineering students go directly into employment upon completion of four years of collegiate education, and this includes a large proportion of our ablest students who possess the most promising personal qualities.

At the same time there is a rapidly increasing need for young engineers qualified for higher levels of technical and scientific work. Engineering education is not keeping pace with the trend of the professions toward more highly scientific types of work. In some fields and in a very real and threatening way, physicists are moving into many posts which are essentially engineering in nature and call for the more creative levels of ability. Yet the need continues, also, for young men to become productive members of society at as early an age as is consistent with their eventual growth to the higher levels of professional activity. This appears to pose the question of how to have our cake and eat it too. One of the answers to this dilemma, to which I have already referred, is the provision of more widespread opportunities than exist at present for young engineers to continue their scholastic education after leaving college. Part-time work can never wholly replace full-time postgraduate study and it should not be expected to do so, but it can supplement it to an important degree. It can, at the same time, aid materially in solving the problem of the post-college slump.

For a number of years, evening postgraduate courses in engineering have been offered by several institutions. This practice has been so successful and has served such important purposes in a few localities as no longer to be debatable as a sound and appropriate form of postgraduate engineering education. Unfortunately work of this type is limited to a minority of the areas in which it is feasible. Of about fifty centers of population in this country in which there are significant numbers of engineers, in only ten are there reasonably adequate provisions for part-time postgraduate work. Not all engineering schools are qualified to offer graduate work of course, but in a majority of industrial centers there are sound institutions which can offer excellent combinations of work in higher mathematics, physical science, and engineering. The number of evening engineering graduate students in centers where such courses are offered is surprisingly large: 3555 out of the entire number of 14,209 graduate students. It must be remembered, however, that the evening student requires at least three times as long to acquire an advanced degree as does a full-time day student. Nevertheless, the figures are significant in indicating unrealized opportunities for service to young engineers in other urban localities.

PART-TIME POSTGRADUATE PROGRAMS

The following statements give some details concerning the scope and variety of part-time postgraduate programs. Urban districts which have the most comprehensive provisions for this type of work are:

New York
Pittsburgh
Chicago
Troy-Schenectady
Cleveland
Philadelphia
Milwaukee

There are also, however, a number of other areas, not all of them urban, in which special types of programs are offered for particular groups of engineers. These are listed not only as a matter of interest, but as indicative of the opportunities for this type of service that exist in other localities. These examples range from the comprehensive programs of Westinghouse and General Electric to those of less comprehensive scope

The Westinghouse program of postgraduate work for young engineers has grown to include co-operative arrangements with six institutions:

University of Pittsburgh
New York University, Polytechnic Institute of Brooklyn, and Stevens Institute of Technology in the New York area
University of Pennsylvania in Philadelphia
Cornell University in Buffalo

Graduate courses are available to Westinghouse engineers in Baltimore, Beaver, Buffalo, Lima, New York, Philadelphia, Pittsburgh, and Sharon, who are employed in 29 offices or divisions of the company. Teachers engaged in the work include both members of university staffs and engineers and scientists with the company.

General Electric offers its famous Advanced Course within its own company organization. This course is of three years' duration and is fully the equivalent of postgraduate work in a college or university. The courses are conducted by the company's own engineers. In addition, General Electric provides opportunities for its engineers to take postgraduate courses in ten institutions: Union, Rensselaer, Syracuse, University of Washington, University of Idaho, Washington State College, Oregon State College, University of Pennsylvania, Massachusetts Institute of Technology, and Northeastern.

Allis-Chalmers has also inaugurated with Illinois Institute of Technology a program of work for its engineers in Milwaukee.

In the aggregate several hundred young engineers of these three companies are pursuing systematic programs of part-time advanced academic work. Many of them are candidates for master's or doctor's degrees. It is important to note that one of the inducements to young graduates to take work of this type is the earned recognition of advanced degrees to which it leads. They know that the work is not only of value in itself, but that an advanced degree is a form of scholastic currency that commands a premium in opportunities and salary.

The value of programs like those mentioned, to the industries as well as to the young engineer, can scarcely be overestimated. It is shown clearly by the positions now occupied by the men who pursued these courses in earlier years.

While the foregoing examples of part-time advanced courses are perhaps the most widely known there are a good many others in operation several of which have been inaugurated recently:

The Ohio State University, in its so-called Twilight Courses, conducts a program of graduate work in co-operation with the Air Force Institute at the Wright Patterson Graduate Center at Dayton, Ohio.

Case Institute of Technology provides evening courses for employees of the Research Laboratory of the American Society of Heating and Ventilating Engineers, as well as for other engineers in practice.

Oklahoma Agriculture and Mechanical College offers courses for engineers of the petroleum industry at several localities in Oklahoma. This is to be noted particularly since Stillwater, the home of Oklahoma A&M, is far from being an urban center, yet the College has overcome the difficulties of its location in offering graduate work for young engineers of its state.

The University of Colorado, at Boulder, offers graduate courses in Denver for engineers of the Reclamation Service.

Similarly, the University of Delaware, at Newark, has a co-operative arrangement under which du Pont engineers pursue graduate work in Wilmington.

The University of Tennessee offers graduate courses for engineers of TVA and the Atomic Energy Commission in Knoxville and Oak Ridge.

As a final illustration, reference is made to the arrangement whereby General Electric engineers at Hanford, Wash., may take work offered by four institutions of northwestern states: University of Idaho, the State College and the University of Washington, and Oregon State College—another example of the overcoming of difficulties of relatively remote locations.

INDUSTRIAL TRAINING PROGRAMS

In addition to provisions for postgraduate work of academic nature for young engineers, a good many industries provide training programs of other types. I refer to the so-called "cadet courses," "loop courses," and the like, of from six to eighteen months' duration which recently employed graduates are required, or permitted, to pursue. Many of these are undoubtedly of value in providing orientation to industrial pursuits and in informing young engineers about company policies and practices. But they serve different purposes from those of the advanced scientific and engineering courses to which I have referred. They are strictly within the realm of responsibility of individual companies, and I am not including them within the scope of the present discussion.

The foregoing statistics of part-time postgraduate work and the examples of the variety of circumstances under which it is offered are cited for two reasons: (1) The evidence they afford of need for such work on the part of young engineers whose collegiate education terminated at the end of the customary four-year curriculum; and (2) evidence of the fact that this need is being satisfied in a variety of instances without deferring the advent of young men to productive life.

As previously noted, there are about fifty industrial communities from Boston to San Francisco and from Minneapolis to Houston in only ten of which important programs of part-time graduate work are offered. An important step in advancing the interests of young engineers, the industries they serve, and the public at large would be taken by promoting the further development of programs such as those mentioned. I believe that ECPD could serve a very useful purpose in aiding to promote such a movement. Not that ECPD should or could intrude on the work or policies of colleges and universities. That would be neither appropriate nor necessary. But it could give publicity to the facts of the underlying problem of the postscholastic development of young engineers and to the manner in which it has been successfully dealt with in a number of localities and under various conditions.

II PROFESSIONAL IDEALS AND CONCEPTS

What has just been said deals with the increase in technical proficiency of a young engineer. An equally important phase of his development is his growth in stature as a professional man and as a citizen. His development in these respects does not lend itself readily to an academic type of treatment; it cannot, in the adult, be made the responsibility of colleges and universities. In the last analysis of course the responsibility for growth and development rests on the individual himself just as it does in any educational process. But a competent sponsoring agency may do a good deal to assist him in planning his self-development and even in carrying it out. Since it is largely professional ideals and concepts, which reflect themselves in good citizenship, that we are here considering, it seems clear that it is the responsibility—and the opportunity—of the organized engineering profession to deal with this problem. ECPD has recognized this responsibility as coming within its mandate from its sponsoring groups. From the nature of its organization, it is clear that ECPD can scarcely be an operating organization in this connection as it can, for example, in the accreditation of engineering curricula. But it can and should be the body to formulate standards of professional conduct, as it has done in preparing canons of ethics, and it can guide and stimulate various professional groups in promoting the professional growth of young engineers. It can, in short, take the lead in this important function of a professional body.

Some of this ground has already been cultivated, but only a start has been made. Efforts should continue along the lines already established, and they should be broadened and strengthened. The agencies through which measures advocated and defined by ECPD should be carried out are clearly the local organizations of engineers that exist in all parts of the country, especially those affiliated with the great national societies. When one considers the practicable means of conducting a program of such breadth as the one herein outlined, which would involve a great many young men and educational institutions as well as the co-operation of the local sections of the national societies, he is brought to the conclusion that it is not sufficient to attempt to have it carried out wholly by a voluntary committee whose members are busy with their regular occupations. Such a committee can and should formulate policies and lay plans, but it can scarcely be expected to carry them into actual operation. What is needed, in stimulating and organizing work relating to the professional development of young engineers, both in relation to their growth in technical competence and in their broader professional qualifications, is the services of a competent leader who can devote his full time to it. Such a man will need to be paid a salary commensurate with the high qualifications he must possess. He will need a small office staff and a travel budget. He should of course report to a standing committee of this body which should formulate general policies. I believe ECPD should set for itself the task of establishing such a movement on a sound basis. Nothing that I can think of as a possible activity of ECPD would, in the end, yield such large returns on investment.

1948 ASME Annual Meeting Papers

FIFTEEN pages of digests of available 1948 ASME Annual Meeting preprints appear in this month's ASME TECHNICAL DIGEST, pages 36 to 50. The November and December, 1948, issues of MECHANICAL ENGINEERING also contained digests of available 1948 Annual Meeting preprints, as will forthcoming issues.

This month's TECHNICAL DIGEST covers a wide variety of subject matter, including reheat turbines, gas-turbine power, machine design, fuels, applied mechanics, aviation, industrial instruments, lubrication, materials handling, heat transfer, magnetic inspection, hydraulics, marine power, metals engineering, and quality control.

ARCTIC AERIAL NAVIGATION

A Method for the Analysis of Complex Activities and Its Application to the Job of the Arctic Aerial Navigator

By J. M. CHRISTENSEN[1]

WRIGHT-PATTERSON AIR FORCE BASE, DAYTON, OHIO

INTRODUCTION

THIS report describes a method employed in gathering activity data under rather unusual and difficult circumstances. The chief merits of the method are simplicity and flexibility of application.

The data were gathered in an effort to obtain answers to three questions with regard to arctic aerial navigation:

1 What new equipment or what changes in present equipment will result in the greatest improvement of the arctic navigator's efficiency?

2 What is the optimal layout of the equipment in the arctic navigator's workplace with regard to convenience, importance, frequency of use, and reduction of fatigue?

3 What minimum crew requirements will insure satisfactory navigation of present aircraft in the arctic, and how can the number safely be reduced in the future?

Modern Aircraft Requirements. Requirements for modern aircraft demand increased speed, increased range, and increased pay load. One method of satisfying partially these performance objectives is to decrease the number of air-crew members. The significance of this method may be more fully understood when it is realized that each crew member on an average-sized modern bomber represents a weight liability of approximately 1500 lb (1).[2] Requirements already dictate that aircraft larger than the familiar B-29 will be operated by less than one half the crew required to operate that aircraft.

The Arctic, however, is not co-operating in this simplification program. It is incessantly and insidiously challenging all efforts to conquer it by way of air. The difficulties that both air crew and ground crew experience in lower latitudes are magnified enormously in the Arctic. The transition for the navigator[3] is singularly difficult. Conventional methods of directional reference are not reliable. Weather forecasts are few and inaccurate. There are extended periods of twilight during which the sun chooses to lie immediately below the horizon, refusing to allow itself to be used as a celestial guide, yet illuminating the sky sufficiently so that none of the other stars may guide a wayward crew to its destination.

Reconnaissance squadrons in Alaska have met this challenge by assigning two or three navigators and one or two radar operators to each mission, and planning time of departure so as not to be caught in the twilight zone for extended periods. This has solved the navigation problem for the present, but has added a weight liability which could never be tolerated in combat bomb-carrying aircraft.

Weight-Time Relationship. Knowing the weight cost of one air-crew member, it is possible to write the relationship between operator time and aircraft weight. Assume that a particular aircraft has a crew of 10 men, and that together these 10 men are engaged in 600 min of activity each hour. Assume, in addition, that by introduction of more efficient methods, better equipment and better arrangement of equipment, it is possible to save 6 min of each individual's time each hour. Thus, each hour a total of 60 min is saved, and 540 min of work remains to be accomplished. By redesigning jobs and reassigning personnel, it then should be possible to do all the work with 9 men. In actual practice, of course, it is not possible to save 6 min of each individual's time and reshuffle all duties. Useful results are obtained by concentrating on the absorption of one individual's duties by other crew members engaged in somewhat similar activities. The absorption of the radar operator's duties by the navigator is a case in point. (The radar operator may argue that it is he who is absorbing the navigator's work.)

A New Measure of Time: One Minute Equals 25 Pounds.[4] The time saved may seem more realistic to an aircraft designer if it is stated that 1 minute is worth approximately 25 lb (1500 ÷ 60), i.e., for the aircraft considered in the Curtiss-Wright report (1). Provided other things are equal, this ratio provides a rough guide for estimating the value of new equipment and the design of air-crew workplaces in terms of weight liability. This point of view admittedly does not give consideration to such factors as training air-crew members in a multiplicity of duties, maintaining satisfactory proficiency in all duties once they are trained, ground and aerial maintenance of any equipment used in lieu of personnel, nor the relative effectiveness of equipment and personnel for a specific job.

A DESCRIPTION OF ACTIVITY ANALYSIS

Data Required. At the initiation of this project it was felt that data were required regarding the following:

1 How often each item of equipment was used.

2 The amount of time required to obtain the information the equipment was designed to supply.

3 The general sequence in which operations were performed and equipment was used.

These data were to be used in determining needed new equipment, improvements needed in present equipment, techniques requiring simplification, optimal arrangement of the workplace, and estimations of minimal crew requirements for arctic operation.

Techniques Considered. Various techniques for obtaining the data in this report were tried (2, 3, 4). A method of timing

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[1] Research Psychologist, Psychology Branch, Aero Medical Laboratory.

[2] Numbers in parentheses refer to the References on page 22 of this issue.

[3] The term "navigator" as used in this report includes navigation by radar.

The opinions expressed herein are those of the writer and are not to be construed in any way as necessarily representing official United States Air Force opinion or policy.

Contributed by the Aviation Division and presented at the Aviation Conference, Dayton, Ohio, September 20–21, 1948, of The American Society of Mechanical Engineers.

[4] The basic idea of this ratio is that of Dr. Paul M. Fitts, Chief, Psychology Branch, Aero Medical Laboratory.

each activity with a stop watch, although usable, was discarded because of the difficulty encountered in recording short items when they appeared in rapid succession. A motion-picture technique was found to be impractical because of the difficulty of installing the necessary mounts, the difficulty of following the navigator around the crowded workplace, the fact that one could never be sure prior to take-off which airplane would be used, the lack of room for additional equipment, and the low level of illumination at night. More light could not be introduced as it would have impaired the dark adaptability of the navigator. This latter objection could perhaps be overcome by use of infrared photographic methods.

Sampling Method of Activity Analysis. After rejection of available methods, the sampling method of activity analysis was developed. It constitutes a new technique for gathering this type of data—data somewhat similar to what Magnard and Stegemerten call operations analysis (5), and the motion and time analyses (2, 4). Activity analysis makes use of sampling theory in order to obtain the times devoted to different aspects or elements of a complex activity, and the general sequence in which those elements are performed. The definition of "elements" is entirely up to the researcher, who can make them as fine or coarse as he desires. A timer set for a specific interval triggers a buzzer audible only to the observer. Each time the buzzer sounds, the observer records in code the activity in which the observee is engaged at that instant.

The Sampling Interval. The length of the sampling interval is arbitrary. On the missions described in this report an interval of 5 sec was employed. This interval was chosen because (*a*) the shortest activity in which the observer was interested (other than transition time) took more than 5 sec; (*b*) the observer easily could record the activities of the navigator under all flight conditions (rough air, crowded workplace, etc.); and (*c*) the buzzer sounded often enough to keep the observer awake. The latter is a real problem under the conditions described in this report. The buzzer tone did become monotonous, although this condition was alleviated somewhat by varying volume periodically. It would have been helpful if the pitch of the tone also could have been varied.

If the person being observed is shifting rapidly from one activity to another and the observer is interested primarily in the sequence of activities, he may wish to use a sampling interval shorter than 5 sec. Laboratory experimentation has shown that with a little experience an observer can use an interval as short as 2 sec. Breakdown at shorter intervals occurs because of the time required to record the code symbols. It is believed that use of a special recording device (perhaps depressing appropriate keys on rolling wax paper) would enable the observer to make a continuous record of activities of very short duration.

Analysis of the data indicated that essentially the same results would have been obtained had any sampling interval up to 30 sec been employed. The advantage of this result is that the observer, if necessary, could record the activities of several operators simultaneously, e.g., first navigator, second navigator, and radar operator, if they were located near each other. When the buzzer first sounded the observer would record what A was doing, when it sounded 10 sec later, he would record what B was doing, when it sounded 10 sec later, he would record what C was doing, then back to A, and so on. This would disrupt the sequential recording, but would give a reliable over-all picture of the time devoted to each of the activities by the three operators. This is a real advantage, as one is anxious to get as much data per hour as possible under conditions such as described in this report.

Point of View of Activity Analysis. Within limits, the point of view of activity analysis is centered in the person being observed. The analyst looks for total job elements which should be replaced by equipment, changes which should be made in the design of present equipment, and changes in design of workplace which would help the operator obtain better results for his effort. Emphasis is placed on fitting the equipment and workplace to the individual rather than forcing the individual to perform with equipment and work arrangements which may not be in harmony with his inherent abilities and basic limitations as a human being.

Advantages of the Sampling Technique. The sampling technique has a few distinct advantages. The observer can keep pace with the subject for long periods of time. Light, simple, self-contained, hand-carried equipment is employed, and no modifications or installations in the aircraft are required. The large number of samplings provides assurance that the less time-consuming activities of air-crew members are adequately sampled. It tells also exactly what the observee is doing, i.e., what piece of equipment he is using, how long he uses it, and how frequently he uses it.

The cost of the project was minimal. The project (including the analysis of the data and writing of reports) required the full time of one individual for approximately 4 months. The equipment cost approximately $7.50. No special flights were made; the analyst went along on regular operational missions.

Observer Requirement: Familiarity With the Job. It is essential that the activity analyst be very familiar with the job he is attempting to analyze. In this case the observer was a former navigator and radar operator and, in addition, three short trial missions were flown in the United States during which practically everything the navigator did was timed and recorded. The general categories employed in the present study were deduced from those data.

Value of Motion and Time. It can be seen that such an analysis differs somewhat from conventional motion and time analysis. This should not be interpreted to mean that motion and time techniques are considered valueless or are entirely distinct from activity analysis. On the contrary, perhaps it is more nearly correct to say that refinement of the job (navigation, in this example) has not yet reached the point where conventional motion and time techniques could be employed profitably. There is little use to worry about milliseconds when there are minutes and hours and lives to be saved. Once the workplace has been refined sufficiently and all equipment is standardized, final polishing with a micromotion study may be in order, although it is believed that the operator may have been eliminated from the crew by then. It is not too difficult to envisage that time when one or two specialists can handle all the duties involved in flying great aircraft, even in time of war. The ultimate of no men, of course, was employed in rudimentary and restricted fashion during World War II.

Description of Timing Apparatus.[6] A cam with 12 teeth was installed in a spring-wound clock on the same shaft as the second wheel. This cam momentarily closed a set of contact points every 5 sec, completing a circuit to a sensitive relay wired to operate as a buzzer. A headset and volume control were wired in series, and this circuit was wired in parallel with the buzzer. Powered by a single dry cell, this unit introduced a rather unharmonious but effective tone into one earphone. The other earphone was connected with the regular interphone system so the observer could tell when the person being observed was on the interphone. A single telephone-type dry cell will last several months under this service.

APPLICATION OF THE TECHNIQUE

Source of Data. Arctic missions were flown with a Photo

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[6] M. J. Warrick, Psychology Branch, Aero Medical Laboratory, designed this device.

Reconnaissance Squadron September 9, 1947, and September 17, 1947, and with a Weather Reconnaissance Squadron September 12, 1947. Each mission lasted approximately 15 hr. This was approximately the length of the average mission flown by these squadrons.

During the first mission, seven 45-min periods were spent recording the activities of the first navigator and two periods were spent recording the activities of the radar operator. During the second mission, five 40-min periods were spent observing the first navigator, four 40-min periods were spent observing the second navigator, and three periods were spent observing the radar operator. During the third mission (which was aborted at photo destination because a heavy undercast precluded any possibility of photography), five periods of 40 min were spent recording the activities of the first navigator and two were spent obtaining activity data on the second navigator. The periods were reduced from 45 min to 40 min in order to allow the observer time to move from one compartment to another, eat, take pictures of relevant conditions in the aircraft, rest, and observe a little of the scenery.

A Word About the Sample. The observer went on the first three missions flown after arrival at Ladd Field, Fairbanks, Alaska. No preselection of navigators was made, and there is no reason to believe that the navigators observed were atypical. All had 2000 hr or more in the air; all had extensive experience in theaters throughout the world before going to Alaska. They represent a homogeneous group of expert arctic aerial navigators.

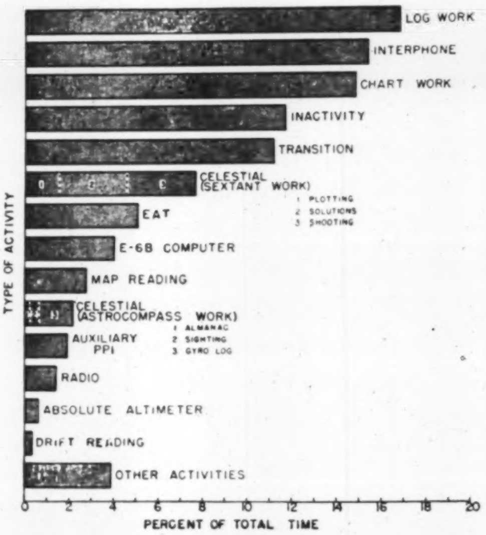


FIG. 1 DISTRIBUTION OF FIRST NAVIGATOR'S TIME

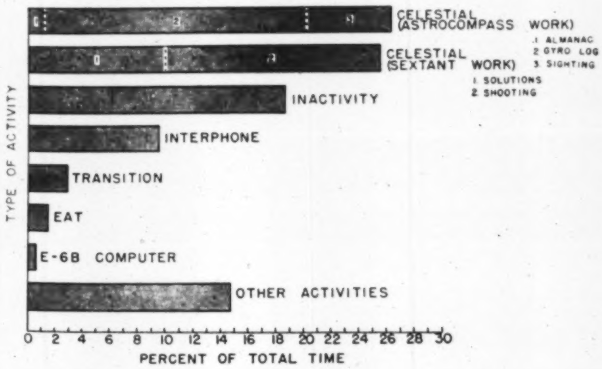


FIG. 2 DISTRIBUTION OF SECOND NAVIGATOR'S TIME

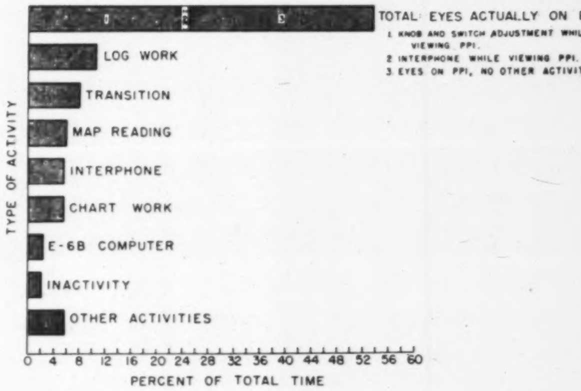


FIG. 3 DISTRIBUTION OF RADAR OPERATOR'S TIME

Findings. Over-all summaries of the activity analysis data for the first navigator, second navigator, and radar operator are shown in Figs. 1, 2, and 3. In addition, detailed information was obtained regarding the characteristics of the distributions of time devoted to each of the activities, and the general sequence in which activities were performed. These two latter groups of findings will not be discussed in this report.

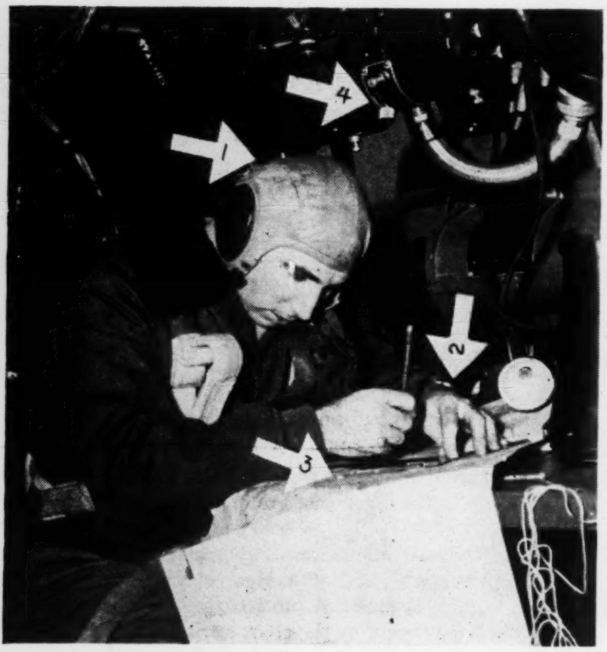
RECOMMENDATIONS RESULTING FROM FINDINGS

Workplaces and Their Arrangement. The workplaces provided for arctic navigators engaged in reconnaissance missions are too small and restricting to permit efficient operation (see Figs. 4 and 5). Items of equipment are not arranged with adequate cognizance of their importance and frequency of use. No space is provided for the extra equipment needed on arctic flights.

A more nearly adequate workplace could be provided by installing an astrodome in the forward section of the airplane. A hydraulically operated chair should be provided for raising and lowering the celestial observer in and out of the astrodome. A gyrocompass should be provided at the astrodome position in order that the second navigator may check heading and precession rates without leaving his seat or calling the first navigator on interphone. A remote turn control should be provided, in order that the second navigator may make minor corrections in heading without calling the pilot on interphone. These steps would increase significantly the efficiency of checking precession rates, increase the precision of the heading of the aircraft, and decrease the amount of interphone conversation.

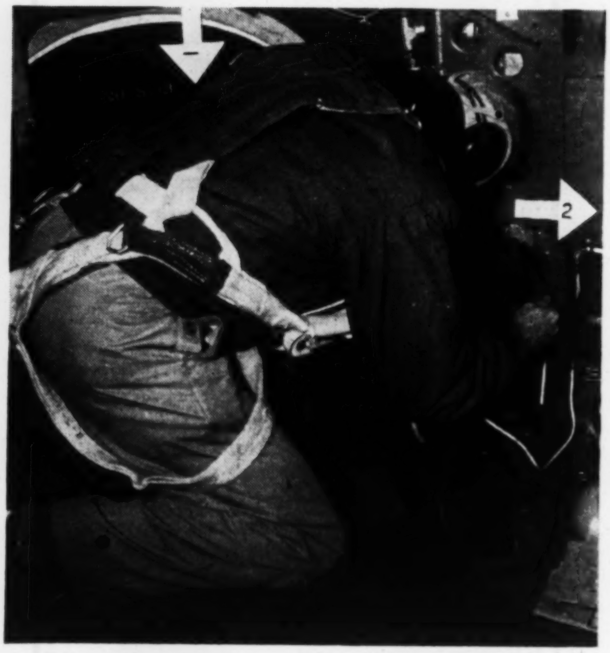
The radar operator should be located in the same compartment with the navigator because of the similarity of their work. This would decrease the amount of interphone conversation and permit more efficient cross-checking of navigational information. This would also make it possible to employ 1037 operators efficiently. (The 1037 operator is trained to perform the duties of navigator, bombardier, and radar operator.)

All instruments and equipment should be as accessible as space limitations will permit. At present the first navigator spends 11 per cent of his time transferring from one activity to another (e.g., see Fig. 6). Proper allowances must be made for the importance of each instrument and the frequency with which it is used. The detail of the arrangement of new aircraft is classified information and cannot be discussed here. However, one item is of special interest. The 1037 operator will be required to operate so many different equipment consoles that it constitutes a problem for the designer to get all the equipment



1 Position of head
2 Small table
3 Lack of storage place for tools
4 Random placement of control knobs

FIG. 4 NAVIGATOR'S WORKPLACE IN RECONNAISSANCE AIRCRAFT

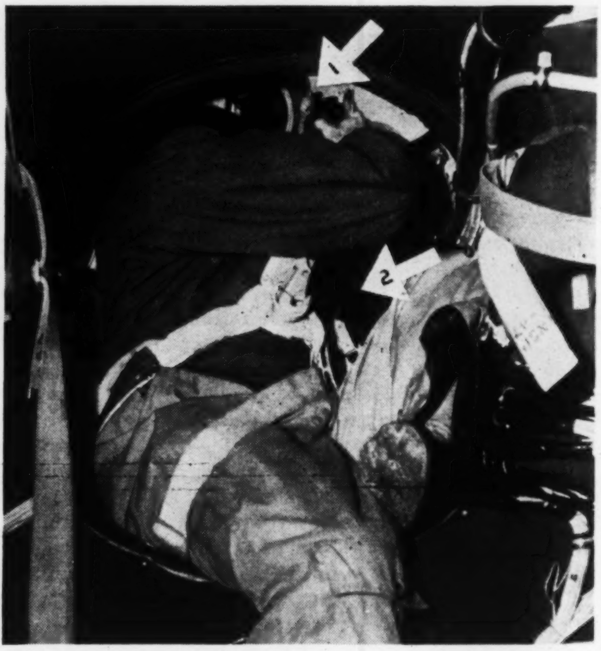


1 Position necessary for reading drift
2 Location of driftmeter with respect to worktable

FIG. 6 NAVIGATOR READING DRIFT IN RECONNAISSANCE AIRCRAFT

near him, still leave him room to work, and keep the equipment within the confines of the aircraft. In order to solve this, it is recommended that control boxes be separate from other black boxes in the system, and that such other boxes be remoted. In addition, the equipment has been mounted on tracks. When the operator wishes to use any particular equipment-control console, he slides out the one he needs at the moment and returns it to its position when not using it.

Convenient storage places should be provided for all loose items of equipment. This not only makes such items always accessible, but conserves table space for immediate work only, and prevents the larger items from becoming dangerous unguided missiles in event of an emergency landing.



1 Position necessary for sextant shot
2 Impossibility of wearing parachute pack (Dangerous in event of astrodome blowout)

FIG. 5 NAVIGATOR WORKING IN ASTRODOME OF RECONNAISSANCE AIRCRAFT

Equipment. Analysis of the activity data provided many clues regarding redesign of present equipment and development of new equipment. This is particularly important in the peacetime Air Force because of the limited amounts of money available for research and development. Every effort must be made to get maximum return for every dollar spent. An objective method of analysis under actual operational conditions provides data from which experienced personnel may draw conclusions regarding the proper placement of emphasis in research and development programs.

A few typical conclusions regarding equipment deficiencies as indicated by the data from the three missions will be presented. Most of them were substantiated by interview with experienced navigators, radar operators, and pilots of the arctic area (6, 7).

The first navigator, second navigator, and radar operator spend far too much time on log work. The time could be reduced significantly if a critical examination of the present logs and the data therein were made with a view toward simplification, elimination of needless repetitive recording of certain data, and recording of data that are never used.

A careful analysis should be made of the log requirements of navigators engaged in various types of operational flying with a view toward designing different logs for different types of missions. Theater navigators probably would be very pleased to submit their considered best log designs for their particular types of navigation. The practice of attempting to design one standard log to serve all theaters is inefficient and wasteful. Navigational procedures vary too widely from one theater to another.

Automatic recording of time, air speed, heading, altitude, drift, and temperature would save the navigator considerable time and increase the accuracy of his results. At present the navigator reads and records his instrument indications at convenient intervals. Unfortunately, no objective evidence is available regarding the reliability of such readings, although the Aero Medical Laboratory has plans for such a study. The study should disclose how often the instruments must be read in order to obtain any required accuracy.

It would be much more efficient if the instrument readings could be recorded automatically on a tape at some regular interval and averaged automatically when needed. These tapes could be adhered directly to a special log. The navigator would then be required to pay attention to the instrument readings only when needed for further computation. This would reduce significantly the amount of time spent in routine instrument reading and recording. In addition the data available as a basis for other computations should be more reliable.

If, in addition to this automatic recorder, an automatic sextant and astrocompass, and more precise directional gyro can be developed, the author firmly believes that a 15-hr arctic mission will require not two or three navigators and two radar operators, but only one operator. The designer will then have added not over 300 to 400 lb of additional equipment, and will have eliminated at least three crew members. Another problem is introduced here, however, which must be recognized. The equipment must be foolproof and easily maintained. Additional ground-crew maintenance personnel may be required to keep the equipment operating. The logical end result is, of course, the completely reliable, light, fully automatic, ground position indicator, capable of operating under any and all weather conditions anywhere over the globe.

The first navigator, second navigator, and radar operator spend, respectively, 15 per cent, 10 per cent, and 6 per cent of their time on the interphone system. Several changes could be made which would increase interphone efficiency. At present the throat microphones and headphones become unbearably uncomfortable after a few hours. The many wires usually lie across the navigator's table and become entangled with his other equipment. He has to remove earphones and throat microphone before doing any work away from his immediate area and then often neglects to replace them when he returns to his workplace. Use of the present intercommunication system too often involves putting the headphones in place, searching for the microphone and microphone switch with hands or feet, and stretching to reach some position on a jack box.

Most of these inconveniences and inefficiencies could be eliminated by installing a system similar to interoffice communication systems. Ambient noise levels in modern aircraft are low enough to make such a system practicable. The personnel might wish to wear special earplugs or cotton wadding when using a system of this nature, as it has been shown that such devices increase the ability of personnel to understand conversation when ambient noise levels are relatively high (8, 9). Talking, in general, is an inefficient means of intra-inter-aircraft communication. It is time-consuming and subject to errors. More streamlining of interphone methods or development of a completely revolutionary method for transmission of data in the air is indicated.

The first navigator spends 15 per cent of his time plotting, writing on, and studying his chart. This is exclusive of the time spent in map reading (pilotage) and plotting celestial lines of position. This time could be decreased by development of more efficient plotting tools and charts.

An exhaustive study of arctic chart requirements is also indicated. It is understood that the Aeronautical Chart Service is engaged in such a project. This study should include an adequate analysis of the comparative advantages of large-scale and small-scale charts.

The three activities described, i.e., log work, interphone, and chart work, plus the time devoted to transition, i.e., transferring from one activity to another, consume approximately 60 per cent of the time available to the first navigator. Another 15 per cent is devoted to eating, resting, and miscellaneous activities. This leaves only 25 per cent of the time or 15 min per hr which the first navigator can devote to the gathering of actual basic navigational data, such as sextant observations, astrocompass observations, drift reading, radio, etc. It is not surprising that the first navigator needs an assistant to gather the majority of his raw data for him.

More efficient methods of celestial observation and solution are needed. Navigators of the future, operating at extremely high altitudes, probably will rely more and more on celestial guidance, provided developments in that method of navigation can keep pace with the speed requirements of future aircraft. Celestial navigation has one great advantage in time of war. To date, the stars cannot be jammed by the enemy.

By employing activity analysis, it was possible to determine how often the operator used each control and the sequence in which he used them. It is interesting to note that the two controls the operator adjusted most frequently are about as far apart as possible on the control panel. These two controls nearly always were used in rapid alternate sequence and should have been located side by side and so shaped that they could be distinguished readily from all other controls on the panel as well as from one another. This substitution of positive kinesthetic identification for visual identification would require many less visual accommodations and would result in a reduction of eye fatigue.

Minimum Crew Requirements. Further analysis of the data permits estimation of the minimum time requirements for arctic navigation. It is assumed that the weather and other conditions which prevailed during these observations were typical. Continued use of present equipment and methods is also assumed.

The data are based on three long-range arctic missions (6) and data gathered in interviews with experienced navigators (7), and convince the author that under present conditions, employing present equipment, and with present workplace layout, it is not possible for one man to accomplish successfully the work now done by the first navigator and second navigator (see Table 1). If present navigational standards are to be maintained, one of two things must be done. Either two men must remain assigned to do the navigation, or more automatic equipment, better equipment, and a more efficient workplace must be made available to the one operator. It should be noted, however, that even a perfect workplace layout alone (i.e., no transition time) would not permit one man to do all the work. There would still be 83 min of activity per hour. Clearly, improvement of equipment, substitution of automatic equipment, and/or simplification of some of the methods (such as log, gyrolog, celestial) are necessary before one navigator will be able to do the work now done by two navigators.

The possibility of two men doing the work of three men (first navigator, second navigator, and radar operator) appears much more feasible (see Table 2).

At present, minimum requirements for the three jobs would require 146 min per hr. There are, of course, only 120 min available to two men. The radar operator should be moved to the navigator's compartment, the present astrodome improved, and a small chair with a hydraulic lift provided for use in the astrodome.

TABLE 1 FIRST NAVIGATOR AND SECOND NAVIGATOR

(Estimated time requirements if jobs of first navigator and second navigator are combined)

Activity	Estimated minutes per hour	
Celestial work—sextant:		
Sighting	11	
Solutions	8	
Plotting	1	
	—	
		20
Celestial work—astrocompass:		
Sighting	3	
Gyrolog	13	
Almanac	1	
	—	
		17
Log book		10
Chart work		9
Transition		9
Interphone		6
Rest		5
Eat		3
E-6B computer		3
Map reading (pilotage)		2
Auxiliary PPI		1
Radio		1
Computing position reports for radio operator		1
Search for equipment		1
Absolute altimeter		1/2
Drift		1/2
Miscellaneous		3
		—
Total		92

Notice the cluttered and crowded condition of the present workplace, Fig. 4. If the Loran and SCR-718 units were mounted on tracks, and all radar units, except the control panel and radar scope, were installed across the aisle it would be quite possible to make all necessary radar and navigation equipment available to two operators, and it should be possible for two navigators to handle missions of 12 to 15 hr in the arctic. Attempts to handle these three jobs on extended missions with two men and present workplaces and equipment will result in a lowering of the quality of navigation. This should not be tolerated. The importance of a good system of navigation in the arctic, embodying adequate checks and cross-checks, cannot be overemphasized.

OBSERVATIONS REGARDING FATIGUE

The Navigator. Objective evidences of fatigue and its effects are notably difficult to obtain, and this situation was no exception. However, a comparison was made of the amounts of time spent working and not working. Navigators felt that, on the average, they could work 12 hr before they experienced any appreciable amount of fatigue. Perhaps if the missions were 20 hr long, the operators would not have experienced serious "fatigue" until 17 hr or so had passed. Data from these three flights suggest (the "suggest" is emphasized), however, that the true "fatigue" curve begins to accelerate positively much before 12 hr and increases at a very high rate, until at approximately 13 hr the curve begins to flatten, though as pointed out previously, these data may be nothing more than a function of total mission length. The data do, however, suggest a hypothesis that fatigue affects the efficiency of the navigator much sooner than he realizes and later levels out at some plateau. Further studies on fatigue and its effects on performance are being carried out at the Aero Medical Laboratory.

Radar Operator and Eye Fatigue. It is significant that the radar operator has his eyes on the radar scope 54 per cent of the time. Unfortunately, the data available regarding the effect of continuous scope observation on eye fatigue and operator efficiency are meager and do not pertain directly to aerial operation. The available data indicate that continuous operations involving 4 hr or more should be followed by long periods of rest (10). The typical arctic mission lasts approximately 15 hr. Sometimes only one radar operator is carried on a mission. It seems certain that impairment of the efficiency of the radar operator, and likely that impairment of his vision, may result from the prolonged periods of eye strain to which the radar operator is now subjected. Observation of radar scopes in the air was not studied in the research referred to in this paper, although this does introduce the important factor of vibration. The condition is particularly serious when ice attaches to the propellers, and then is thrown from one or two blades. When this condition exists, the vibration is so great that the radar operator must grip the radar oscilloscope with both hands in order to see the picture at all. (The oscilloscope seems to have a hypnotic effect for some operators. One operator told the observer that during one mission he had fallen asleep twice at his 'scope and had awakened only when he fell off his chair and bumped his head on the camera hatches!)

TABLE 2 FIRST NAVIGATOR, SECOND NAVIGATOR, AND RADAR OPERATOR

(Estimated time requirements if jobs of first navigator, second navigator, and radar operator are combined)

Activity	Estimated minutes per hour, two operators	
Celestial work—sextant:		
Sighting	11	
Solutions	8	
Plotting	1	
	—	
		20
Celestial work—astrocompass:		
Sighting	3	
Gyrolog	13	
Almanac	1	
	—	
		17
Reading radar scope while engaged in no other activity	17	
Engaged simultaneously in other activity	(15)	
	—	
		17
Log		15
Radar control adjustments		15
Transition		13
Chart work (including wind-run charts)		12
Rest		10
Eat		6
Map reading (pilotage)		5
E-6B computer		4
Interphone		3
Search for equipment		1
Radio		1
Computing position reports for radio operator		1
Absolute altimeter		1/2
Drift meter		1/2
Miscellaneous activities		5
		—
Total		146

RELIABILITY AND VALIDITY OF THE DATA

It is recognized that it was impossible to control several important factors in this study. Examples of such factors are representativeness of the missions flown, representativeness of the navigators observed, reliability of one sampling of a particular navigator's performance, uncontrolled weather and climatic factors, bias of the observer, type of airplane, pilot, time of take-off, equipment variations, and so on.

In so far as possible, the effect of such factors has been subjected to statistical treatment, and the results lead the writer to conclude that the data are quite reliable, that is, the results are similar to those which would be obtained if the experiment

(*Continued on page* 22)

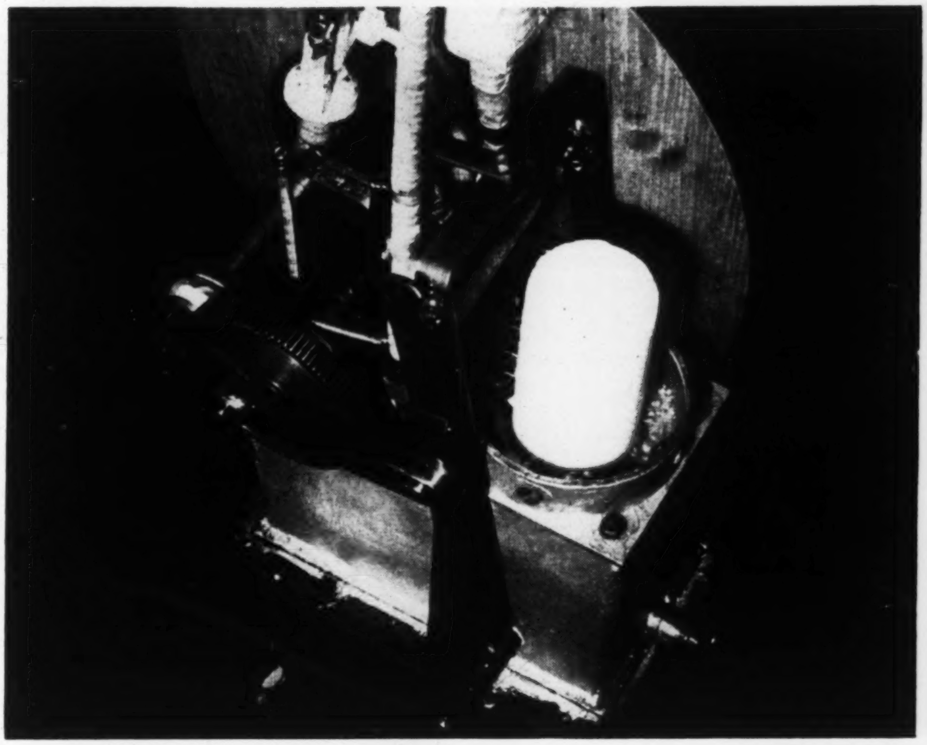


FIG. 1 THE FIRST INCREMENTAL FILM MACHINE GENERATED $3^5/_8$-IN-DIAM ICE BRIQUETTES

ICE MAKING *by the* EXTRUSION PROCESS

By JOHN R. WATT

DEPARTMENT OF MECHANICAL ENGINEERING UNIVERSITY OF TEXAS, AUSTIN TEXAS

INTRODUCTION

THE author's experiments at the University of Texas since 1943 have resulted in the development of a continuous process for generating ice cakes without brine, ice cans, or labor. Direct-expansion freezing cylinders extrude hard white ice in continuous columns suitable for automatic severing into cakes. The "incremental film" principle allows ice formation of approximately 10 lb per sq ft of freezing surface per hr at 5 F suction pressure, or about 30 times greater than ice-plant practice. The pilot commercial 1-ton machine has one moving part and requires floor space 3 ft square. It generates cakes 12 in. × 15 in. of any length. The operating costs are low. The ice is suitable for railway and truck icing, fisheries, dairies, farms, air conditioning, etc.

PROBLEMS IN MODERN ICE MAKING

The largest buyers of ice are the seasonal food-transportation industries, and, since seasonal ice must store easily, this market uses cake ice almost exclusively. Today these industries find themselves dependent upon the slow ice-can system with its large and increasing capital and labor outlays. The very nature of this process discourages improvement. Faster heat transfer in the can is impeded by the ice itself, while colder brine causes cloudiness and cracking of the ice. Thus any cheapening of can ice seems difficult.

To overcome this, several continuous ice-generating systems are now finding use, notably York's "Flakice" and ice-cube machine, Vilter's "Pakice," Vogt's "Tube-Ice," and the new Knowles "Belt-Ice," manufactured in Seattle.[1] These fast processes manufacture ice at remarkable savings but may incur storage problems. Ice flakes and snow ice require double space, while briquettes often freeze together in storage. Consequently no rapid freezing system yet competes where storage is significant.

Furthermore, flakes and briquettes are not as satisfactory in refrigerator cars as cake ice.

Contributed by the Process Industries Division and presented at the Annual Meeting, New York, N. Y., November 28–December 3, 1948, of The American Society of Mechanical Engineers.

[1] The performances and general applications of these systems were compared in a paper, "The High-Speed Production of Ice," by J. R. Watt, *Ice and Refrigeration*, vol. 110, May, 1946, pp. 17–19.

EXPERIMENTS AT THE UNIVERSITY OF TEXAS

In 1943 the author began experiments to develop a continuous process for making cake ice. The first tests investigated the shearing of ice from steel,[2] and proved it practicable (1) to shear ice intact from a submerged freezing surface, (2) to freeze water between the two to form a new ice layer bonded to the old, and (3) to repeat the process layer by layer to generate solid blocks of desired size and shape.

Accordingly, the small machine illustrated in Fig. 1 was constructed. Basically, it was a tank of water in which a double-walled tapered freezing cylinder was mounted big end up and cooled by direct expansion. A perforated ram reciprocated vertically in the lower (or small end) of the cylinder, driven by an eccentric and rocker arm. Later, the eccentric was replaced by cams to give the ram a dwell or "freezing period" between strokes.

When run rapidly, this machine formed nesting circular ice shells about $^1/_{32}$ in. thick, like nested paper cups. When run slowly, it made a broken hollow column of white ice with walls $^3/_8$ in. thick, thus proving that generating thick sections from thin layers was possible.

A second freezing cylinder, of $3^5/_8$ in. diam and different taper, was made and polished to reduce ice adhesion. It soon established that a four-dimensional compromise was necessary; temperature, freezing time, lift of ram, and cylinder taper must all be reconciled. After a reservoir of chilled water was installed at the top, the new cylinder achieved solid ice cakes in early 1946.[1]

Referring to Fig. 1, operation was as follows: With the ram in low position and the machine filled with water, an ice core was frozen in the tapered cylinder. When this was solid, the ram mechanism was started, periodically shearing the ice core from the cell walls and lifting it intact about $^1/_8$ in. Since both core and cylinder were tapered, lifting the ice opened a thin annular void entirely around it. Suction and capillary action filled this with water from the reservoir while the ram returned to its original position. The water film approximated $^1/_{64}$ in. thick and froze in 10 to 15 sec, depending upon temperatures.

Each successive new layer of ice (called the "incremental film" for want of a better term) froze integrally to the one before. Each cycle therefore added new ice below and around the core, forming a column that extruded step by step upward out of the cylinder. About 4 to 5 cycles per min gave optimum output.

With —10 F suction temperature, the ice-freezing rate approximated 27 lb per sq ft of freezing surface per hr. The heat transfer was about 72 Btu/(sq ft)(hr)(deg F) temperature difference, or about 70 times the estimated over-all heat transfer in a can ice plant.

The machine was finally altered to cut the ice column automatically into 5-in. lengths. It is this final form which is illustrated in Fig. 1.

SECOND SERIES OF EXPERIMENTS

In June, 1946, the author was employed by C. W. Murchison of Dallas, Tex., to adapt this process to the freezing of citrus juices, the incremental principle seeming a possible antidote to segregation and cell injury. Three experimental cylinders were made.

The first was cast bronze and extruded a circular column $6^7/_8$ in. diam. Its inner cylinder had vertical fins in the refrigerant space, although heat transfer on the refrigerant side was already excellent as a result of natural agitation in the full-flooded evaporator. When tested with water, this cylinder made above 35 lb of ice per hr. It was abandoned, however, because of metal porosity and excessive ram pressures.

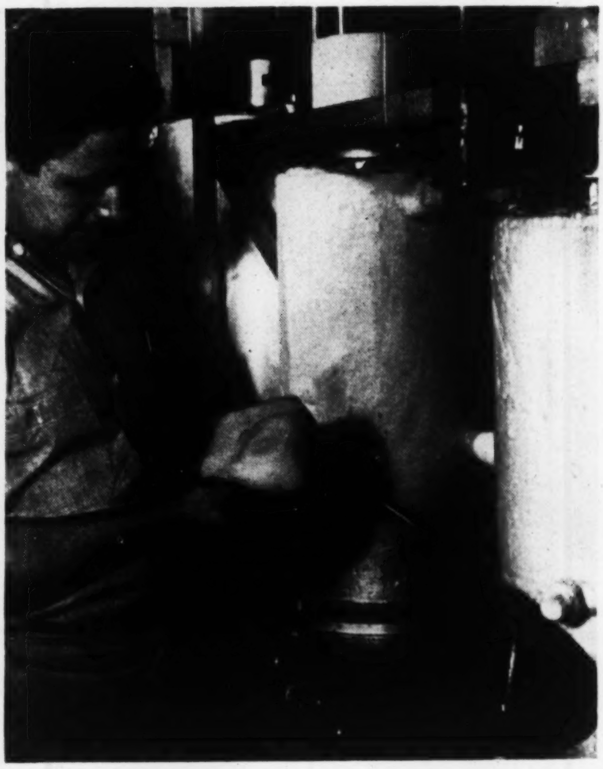


FIG. 2 LATER APPARATUS EXTRUDED RECTANGULAR AS WELL AS ROUND CAKES

The next cylinder was designed to extrude $4^1/_2$-in. × 5-in. bricks of frozen orange juice for consumer packages, so the inner surface and the ram were of stainless steel. This cylinder proved that rectangular extrusion was possible. With a net freezing surface of 1.125 sq ft it froze 17.3 lb of ice per hr for a unit heat transfer of 50.9 Btu/(sq ft)(hr)(deg F).

The third cylinder was similarly constructed but extruded round cakes to fit 1-gal cartons. Its freezing surface was 1.63 sq ft, and its maximum output was 31.18 lb of ice per hr, or a heat transfer of about 63.25 Btu/(sq ft)(hr)(deg F).

In Fig. 2 the latter two cylinders are seen on the test stand, the $6^7/_8$-in-diam ice column showing clearly. The operator is examining a sample brick from the $4^1/_2$-in. × 5-in. column, itself obscured by the traveling band saw for severing the cakes.

These cylinders were operated by cam-driven rams and had a tank-type precooler. The test outputs are of course exaggerated by the low temperatures employed. With a 3-hp Freon compressor, equipped with oil separator, the freezing temperature ranged between —10 and —15 F, a level designed more for juice than for ice. As anticipated, the heat-transfer rates fell below the laboratory machine; the minimum water film was necessarily thicker, slowing the cyclic rate to about 2.3 lifts per min. Nevertheless, the net performance still approached 50 times the estimated over-all average of brine-tank systems.[3]

The juice experiments were conducted in the Rio Grande Valley and were abandoned quickly. Although each increment of juice congealed with adequate speed, the pulp and sugar content kept the mass somewhat soft for the compression loads of the ram.

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[2] The bond between ice and steel fails in shear between 10 and 30 psi; the corresponding ice strength exceeds 100 psi.

[3] For further details see: "Producing Block Ice by Automatic Machine," by J. R. Watt, *Ice and Refrigeration*, vol. 113, October, 1947, pp. 19–20.

TESTS OF FIRST COMMERCIAL-TYPE MACHINE

In 1948 the 1-ton ice-making machine, Fig. 3, was designed by the author as a pilot commercial plant. It was built by the Modern Supply Company of Austin, Tex., and was tested briefly there.

This machine has a tapered rectangular inner cylinder which extrudes an ice column 12 in. × 15 in. in cross section. The inner cylinder is welded from unpolished flat panels of $^1/_4$-in. boiler plate, stiffened longitudinally by ribs in the refrigerant space, and welded permanently into the refrigerant jacket of $^1/_4$-in. rolled steel. It provides a net freezing surface of 8.65 sq ft.

Below the jacket is a precooling chamber, refrigerated by both conduction and suction gases from the evaporator. As shown, the suction line loops upward from the top of the jacket, then turns down and enters the precooling chamber. It emerges still frosted at the lower left, behind the thermostatic expansion valve which controls both jacket and precooler. Water enters the machine through a float valve at the upper rear and is precooled to about 40 F before reaching the reservoir in the top extension of the jacket.

The ram is square and is the only moving part on the freezing machine. It is operated by a hydraulic cylinder below the precooler, the piston rod and the ram retreating into the precooling space between strokes. The hydraulic cylinder is controlled by a Vickers "Power-Pack," a compact hydraulic power unit containing pump, oil reservoir, filter, relief valve, and four-way slide valve in one casting. A $^1/_{20}$-hp timing motor and cam actuate the slide valve, and through it the ram of the freezing cylinder. Both timing and stroke are adjustable.

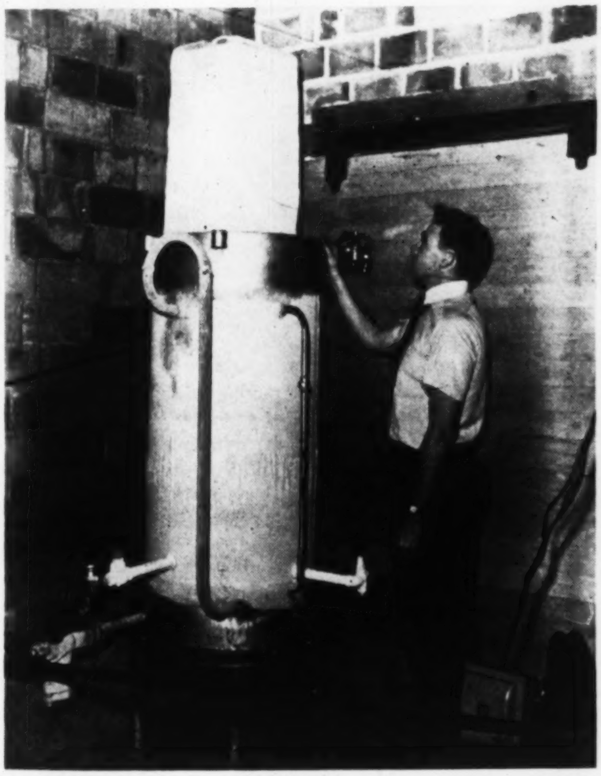

FIG. 3 FIRST COMMERCIAL-SIZE MACHINE EXTRUDES 80 LB OF ICE PER HR

This power unit runs idle between ram movements. Since it is built for two additional slide valves, it should drive three freezing cylinders economically instead of one. Power consumption when running idle, about 0.6 kw per hr, would thus be eliminated, while multiple use of the pump should reduce the net investment. There are no other auxiliaries.

Refrigeration is supplied by a 3-hp Brunner air-cooled Freon compressor charged with methyl chloride. A suction-line heat exchanger is used; there is no oil separator, and no difficulty has been experienced with oil-logging in the full-flooded evaporator.

Thus far no ice cutoff device has been installed. Several automatic arrangements seem applicable, and no difficulty is anticipated in severing 25, 50, 75, or 100-lb lengths for discharge by chute. Similarly, no special difficulties are seen in the construction of multicylinder ice plants. The present machine occupies about 3 ft × 3 ft and generates 1 ton. Welded into one full-flooded casing and controlled by one expansion valve, it seems likely that a four-cylinder 5-ton machine can be built into 3 ft × 12 ft.

TABLE 1 TEST RESULTS ON ONE-TON ICE MACHINE

Air temperature, deg F	75
Compressor speed, rpm	590
Suction temperature, deg F	5
Head pressure, gage psi	106
Compressor power input per hour, kw	2.5
Freezing surface, sq ft	8.65
Insulation	none
Inlet water temperature, deg F	69
Precooled-water temperature, deg F	40
Ice-cake temperature (estimated), deg F	28
Ice-cake cross section, in.	12 × 15
Ram cycle, sec	55
Ice lift per cycle, in.	0.23
Ice lift per hour, in.	13.8
Ice output, volume per hour, cu ft	1.44
Estimated air content (white ice), per cent	3
Hydraulic unit total input, kw	0.75
Hydraulic unit idle input, kw	0.60
Hydraulic unit net necessary input, kw	0.15
Timing motor input (estimated), kw	0.05
Total net power input per hour, kw	2.7
Total net ice output per hour, lb	80

SUMMARY[a]

Ice in 24 hours, total	1920 lb
Kwh/ton ice	67.5
Ice, lb/sq ft of freezing surface/hour	9.25 lb
Heat-transfer rate	51.4 Btu/(sq ft)(hr)(deg F)

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[a] It should be noted that these tests were made with the machine uninsulated.

CHARACTER OF THE ICE

The ice cakes are hard and solid, but not brittle. Although visible to the eye, the laminations are permanently bonded together and the ice melts, chips, and fractures like ordinary ice. Its opacity is due to dissolved gases in the water and does not affect the cooling qualities. Many fish and produce shippers prefer white ice because of its blunter fragments, so clarification has not been attempted.

PERFORMANCE DATA

Tests were conducted in Seattle, at the Electro-Watt oil-burner and furnace plant. Designed as a nominal 1-ton machine, performance has proved quite close to anticipations. Representative results are given in Table 1.

Thus this machine makes solid cakes as fast as other machines make ice flakes. The heat-transfer rate seems greater, due to $^1/_{32}$-in. film thickness instead of 0.070-in. to 0.10-in. flake thickness. More important, this first commercial-size machine shows little diminution in heat transfer from the laboratory cylinders; consequently the extrusion of standard 300-lb bars should be comparably fast.

In summary, it seems justifiable to rate the incremental freezing system as about 30 times faster than comparable can ice plants.

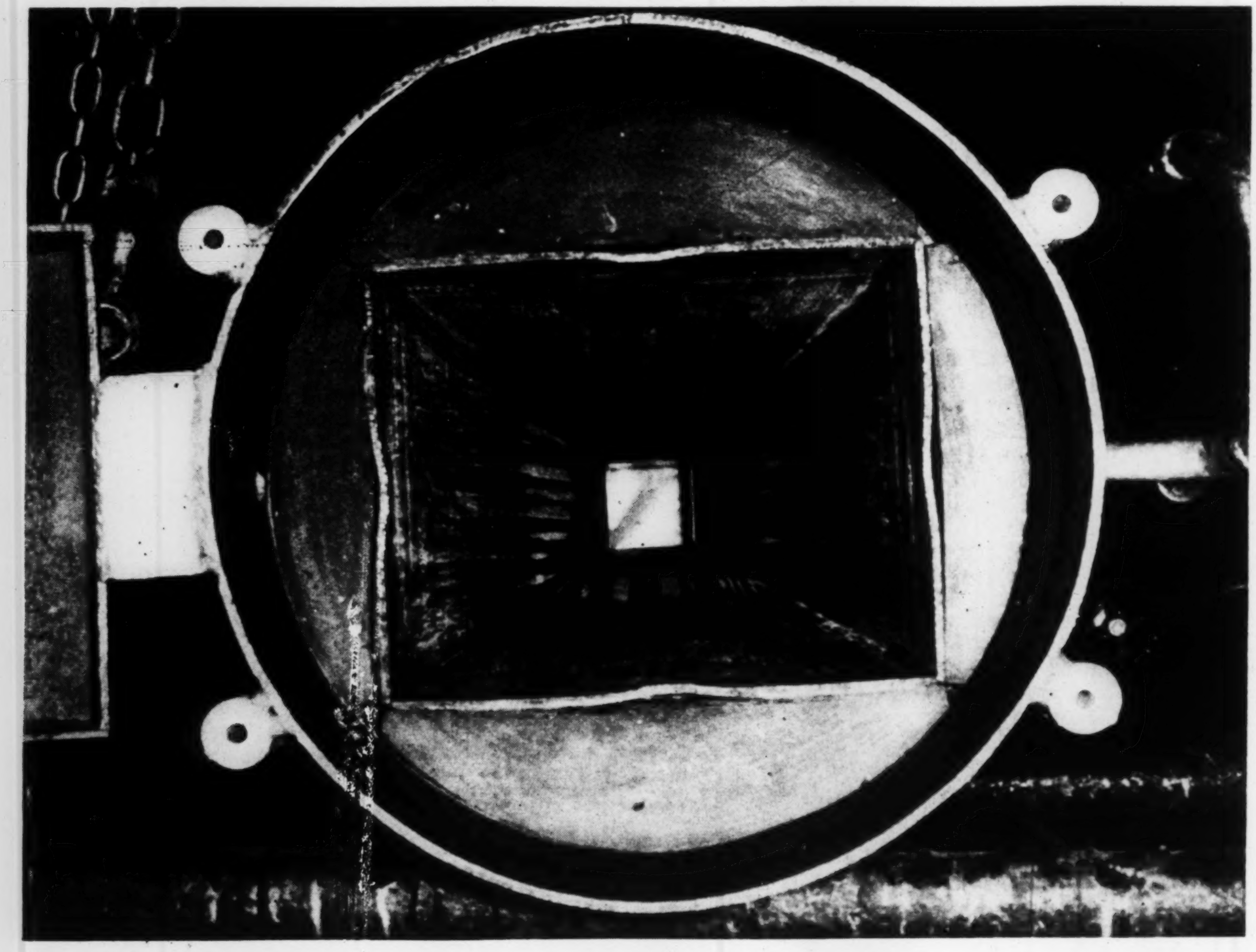
PROPOSED IMPROVEMENT

The shear-off forces encountered in this machine suggest that its freezing surface could be increased safely to 10 sq ft. Output, noninsulated, should then exceed 92.5 lb per hr, while power costs should fall below 58 kwhr per ton. Insulation, use of Freon or ammonia instead of methyl chloride, and multicylinder installations should further improve the economy. Direct ice costs under $1.00 per ton seem likely where power rates permit.

CONCLUSIONS

Tests thus far suggest the following economies are probable under the extrusion process:

1 Building-space requirements are reduced about 80 per cent.
2 The equipment is cheaper than a brine tank and cans.
3 There is one auxiliary, not several.
4 There is no foreseen corrosion problem.
5 Labor costs are reduced.
6 Existing compressors, etc., may be used.
7 Installation costs will be low.
8 Refrigeration losses, radiation, etc., are reduced.



VIEW INTO TOP RESERVOIR AND TAPERED FREEZING CYLINDER OF ONE-TON MACHINE

Similarly, the process should be applicable wherever white ice is acceptable. With one half of America's ice consumed by refrigerated cars and trucks, fishing boats, dairies, drink boxes, farms, and the like, there should be wide markets. Since both investment and operating cost are low, extrusion equipment should appeal to many ice plants faced with replacement or expansion problems.

In so far as is known, this is the only existing process for automatic production of ice cakes. Patents have been applied for.

SOCIAL *and* HUMANISTIC *Problems in* PROFESSIONAL EDUCATION

By ARTHUR VANDERBILT

DEAN, SCHOOL OF LAW, NEW YORK UNIVERSITY; CIRCUIT COURT JUDGE, STATE OF NEW JERSEY

PROFESSOR Greene has characterized ours as a very sick society. After twenty-seven years of active participation in politics, most of that time as the leader of the majority party in one of the largest counties in the nation, I venture to express the conviction that one of the greatest causes of the sickness of society is the aversion of its natural leaders to performing their obvious duties as citizens. So true is this that I am keenly conscious of the fact that, by the mere making of this statement, I shall have lost the attention or at least the emotional response of many readers.

LACK OF INTEREST IN PUBLIC AFFAIRS

Let us analyze the matter into its fundamental elements. Our root difficulty lies in our lack of interest in public affairs and at times in our refusal to accept and act on obvious facts. When Charles Lindbergh came back from Germany before World War II and told the English people that he had seen 30,000 military planes in Germany, they not only refused to believe him but made it so uncomfortable for him for calling their attention to a very real actuality that he had to leave England. When President Roosevelt, in a speech at Chicago months before our entry into the war, endeavored to call our attention to the aggressive tendencies of the Japanese, almost every newspaper in the country booed him down as a warmonger. For several years before the outbreak of World War II our national emblem was not the eagle any more than the lion represented Great Britain. Our national bird during this regrettable period was the ostrich, burying its head in the sand, and signs are not lacking of his return to popular favor.

Not only do we lack any real interest in public affairs but we have very *little knowledge of our government*. If any reader really wants to imitate Dale Carnegie in reverse and become the most unpopular man in town, I have a little game that I can guarantee will make it possible for him to achieve his goal. A good many years ago I was assigned to hold a meeting pending the arrival of Mr. Dwight W. Morrow, then a candidate for the United States Senate. It was held in Montclair, N. J., which calls itself the Athens of America and fairly well deserves the appellation, according to Prof. E. L. Thorndike, who rates it as the second most desirable town in the United States in which to live.

The meeting was made up largely of Republican County Committeemen and women and others active in the party, including the officers of various Republican clubs. I started by asking the 300 or 400 people present to raise their hands and when we came to a question that they could not answer to drop them. I started by asking the names of the President of the United States, the Vice-President, the two United States Senators, and then the names of their Congressmen—not just any Congressman—but their particular Congressman. After the first question hands began to fall. Then I suggested that they name the Governor, the State Senator, the twelve Assemblymen, and the nine County Commissioners, and by this time less than 5 per cent of the hands were still up. Finally, I suggested that they give us the names of the five Town Commissioners who ran their local government. At the end all but two hands were down. I asked no questions as to the character of any of these candidates or their ability to fill their office—merely their names. And only two people out of 300 or 400 who were supposed to be interested in politics could even identify the public officials who were governing them. Do I need to say more?

WAYS TO PARTICIPATE IN PUBLIC AFFAIRS

When it comes to *participation in public affairs*, the situation is, as one would suspect, even more discouraging. There are three chief ways in which each of us may take part in public affairs. The simplest and most indispensable is our assuming our obligations as leaders of *public opinion*. Every individual counts; "there is no power in all the forces of darkness to blot out the light of one small candle." Intelligent leadership of public opinion depends not only on interest and knowledge but on the willingness to assume responsibility. The second way in which we may help is by assuming some degree of *responsibility for party management*. How different our political parties would be if every intelligent man would at least give Election Day and an occasional evening to improving the work of his political party. In the ultimate analysis it all comes down to a question whether we are willing to use Election Day for the purpose for which it is set aside or to spend it on the golf links. It is really just as simple as that. Fortunately, some can and do give much time and thought to the party leadership, which is indispensable in a democracy. Finally, the ablest men, if our system of government is to survive, must be willing to assume the rigors of *public office holding*. It is curious to observe the willingness of our most competent men to take public office when we are threatened with war and compare it with their unwillingness to do so in times of peace. Why must patriotism forever be a wartime virtue? A little more peacetime patriotism would do much to prevent war. No wonder William James refers to "that rarest form of virtue—civic virtue."

We have all been so accustomed to applying the doctrine of the division of labor and the principle of delegation of authority in business matters that we have failed to realize that there are some fields in which division of labor and delegation of authority can have no place. In a democracy, particularly in a democracy in a technological age, one simply cannot delegate one's duties as a citizen and hope to have our complicated machinery of government work effectively. Nor may one's public duties be postponed to a more convenient season. Many men with the very best of intentions have endeavored to achieve private success first with the high ambition that this may be followed by a career of public service. How rarely does it work. There is nothing more pathetic than the successful businessman who wants to serve his community but who has never schooled himself in the world of political realities. A

Presented at the Inter-Professions Conference on Education for Professional Responsibility held at Buck Hill Falls, Pa., April 12–19, 1948, and constituting one of the chapters of the proceedings of the Conference, published in book form by the Carnegie Press, Carnegie Institute of Technology, Pittsburgh 13, Pa.

day of public service and of real interest in the world of politics at the age of twenty-five is worth infinitely more to the community than a month of any old man's leisure.

DUTY TO VOTE

I have been discussing some of the fundamental problems of public life at the higher level. Let us face the facts and see how we have neglected in actual practice the simplest duties of citizenship. The physical act of voting requires little effort. Yet in the Congressional elections of 1942, when we were in the midst of World War II, only 54 per cent of the eligible citizens were interested enough to vote for the members of the wartime Congress which was to control the conduct of the war and perhaps dictate the peace. This, incidentally, was 10,000,000 less than voted in the corresponding Congressional election of 1948. Even in a presidential year the results are almost as astounding. In 1944, only 63 per cent of the eligible citizens voted for President, 5,000,000 less than in 1940. I say nothing as to the character of the voting, as to whether it was honest or intelligent, except that I should like to remind you that intelligent and conscientious voting is a rather difficult act. John Burroughs, the naturalist, was an honest, sincere man and yet he noted in his diary the day following the 1912 election:

"The election goes to Democrats; it might have been worse—might have gone Republican. I intended to vote for Wilson but voted for T. R. on the score of friendship—a thing he never would have done and a thing no man should do."

JURY SERVICE A FUNDAMENTAL DUTY

Take another simple duty of the citizen—jury service. It is astounding how many of our so-called best citizens use every excuse and artifice at their command to avoid this fundamental duty on which so many of our liberties depend. It is just another evidence of our unreasoning hope that so far at least as we are concerned government should be automatic or at least should not make any call on us individually. I hesitate to mention the next step, so depressing is it with reflection on our political morality, but the plain fact is that when our average citizen is served with a ticket for a motor-vehicle violation his first thought is "Who will kill this for me?" and thus we pass from the realm of mere neglect of one's duty as a citizen to active wrongdoing. After having served for ten years as Chairman of the National Committee on Traffic Law Enforcement, I have no hesitancy in saying that the killing of tickets has done more to breed disrespect for the law in otherwise good homes than any other one thing.

GOOD CITIZENSHIP A MATTER FOR EDUCATION

My point is simple. Good citizenship should be taught in the homes, in the churches, in the schools, and the colleges. Obviously, these institutions have not, either individually or collectively, made a good job of it. There is only one other place where these matters can be taught to the future leaders of society and that is in our professional schools where these future leaders congregate. We have plenty to do, everyone knows, with our strictly professional training, but what will it avail us to turn out the best professional men imaginable if they have only a very sick society, as Professor Greene has said, in which to live and work? Must we not at least take the time to bring our students face to face with these fundamental issues? Must we not also set them a good example? The responsibilities of our ablest men as citizens cannot be delegated to someone else, if our system of government is to survive. The salient characteristic of our age is not science or technology or atomic energy. On a world-wide basis it is politics and in many parts of the world power politics. There is no gainsaying this great actuality of modern life. If we are wise, we will recognize it as one of the fundamental premises of our professional education.

Arctic Aerial Navigation

(*Continued from page 16*)

were repeated. Conference with arctic experts lends weight to this contention. The statistical aspects regarding the activity-analysis method and the data of this report are treated in some detail in another report (6), and will be written in greater detail in the near future.

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10 "The Effect of Length and Repetition of Operating Periods on Efficiency of Performance," OSRD Report 3334, NDRC Project SC-70, NS-116, Southern Signal Corps School, Camp Murphy, Fla.

RAMJET engines mounted on the wing tips of a U. S. Air Force Lockheed F-80 Shooting Star have been undergoing flight tests for nearly a year at Van Nuys, Calif., and Muroc, Calif., Air Force Base. The tests have been carried out by Lockheed personnel under the sponsorship of the Air Force.

The ramjets used in the tests were made by the Marquardt Aircraft Corporation, Venice, Calif., and are of two types, one 7 ft long and 20 in. in diameter, the other 10 ft long and 30 in. in diam.

A high air speed is necessary to sufficiently compress the intake air for ramjet engines to operate efficiently, so a "flying test stand" in the form of an F-80 was used. After the F-80 reached the required speed through its standard turbojet engine, the ramjets were ignited. Then the turbojet was turned off and the craft was powered by ramjet alone making it the first man-carrying aircraft to fly under such conditions.

Tests flights have been made by the F-80 to determine air and fuel flow, thrust, and drag of the ramjet units. The tests were made to improve and develop the ramjet engines, not to increase the efficiency of the F-80.

The flying test stand is equipped with automatic observing systems and a motion-picture camera to record instrument readings in flight.

ECPD ANNUAL REPORT

Activities During 1948 and Future Program

By J. W. PARKER

CHAIRMAN, ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

In reviewing the work of the Engineers' Council for Professional Development in the year just ending and the prospect for future accomplishment, it is pertinent to consider whether or not we have an organization sufficient to the task before us. I am strongly of the opinion that the Council needs reinforcement with respect to the number of those engaged in the work, and that its activities require both better direction and better co-ordination than is possible with the present organization. The work of both standing and special committees, effective as most of it is, and all of it loyally undertaken, is nevertheless limited to the scope of their respective committee assignments.

EXTENSION OF WORK OF ECPD

The Council's working force in the accrediting field is well-manned. It consists of the regional accrediting committees organized and directed by the Committee on Engineering Schools and its Sub-Committee on Technical Institute Programs. There are approximately 273 members of these regional committees about 25 per cent drawn from active practice and industry, the remaining 75 per cent from the teaching profession. They and their directing committee of the Council are, I believe, recognized by everyone concerned with engineering education as having made a major contribution to the establishment of higher standards of instruction in the schools of technology throughout the country.

As the Council's work develops, however, it is clear that adequate forces must be organized in each community in which the Committee on Professional Training plans to establish its educational program for recently graduated engineers. With the strong leadership of that Committee and of the Committee on Student Selection and Guidance, it seems practicable to establish local units of ECPD to effectuate such programs and to assist the committees of local societies and local engineering councils in counseling with high-school pupils interested in the possibilities of an engineering career. The role of the local ECPD unit would be to co-ordinate and assist the efforts of existing committees in each of the communities in which guidance and junior training work is carried on. In establishing such local forces ECPD must have the active support not only of the members of its own constituent societies but must call on the members of local sections of other national societies. At the local level all societies would participate.

The Council needs, moreover, a better comprehension of its objectives and the progress being made toward their attainment, on the part of more members of participating societies. Their governing boards and their administrative officers, to begin with, should be continually informed of the work. The meeting which your chairman had with presidents and presidents-elect of several of the societies revealed that these officers had only a general knowledge of the ECPD program and the need for a wider dissemination of this information throughout the membership of these constituent bodies. The Council should have available, for instance, a sufficient number of men in different parts of the country who are thoroughly acquainted with its program and ready to appear upon occasion before the local sections of national societies and other groups desiring to be informed. We have frequently been embarrassed because of having no one sufficiently conversant with the whole program and available to respond to invitations of this kind. In order to assist the individuals given such assignments we would supply them with a collection of Council reports from which they could be informed of current plans and of the progress made with them, and with an outline which might be used as a guide in presenting the program before audiences such as have just been described.

This whole program of increased man power should be discussed by the full Council during the course of this year's Annual Meeting. The working force available for the administrative work of the Council consists of one paid staff member, the elected officers, and an Executive Committee of eight. This administrative group needs the services of a full-time executive secretary. Indeed it would have been impossible to carry on the work during the past two years without the unfailing support of Mr. W. A. Carter who, as a volunteer without formal appointment, has assisted the chairman continually.

Even a moderate increase in full-time staff, however, must await the development of additional sources of revenue. The income and expense budget presented for adoption at this meeting of the Council indicates that there will be sufficient revenue to meet all operating expenses contemplated during the ensuing twelve months. Several new developments have made this possible. For one thing the student testing program, to which reference is made in a later paragraph of this report, is expected to be self-supporting. For another, an increase in fees charged for initial accrediting and the decision to make a moderate charge for reinspection of the curricula at institutions already accredited, will make the work of the Committee on Engineering Schools nearly though not quite self-supporting. The current budget contemplates, furthermore, the use of certain reserve funds now properly expendable for the purposes for which they were appropriated in previous years. In succeeding years additional sources of income will be required. At its last Annual Meeting, the Council approved the appointment of a committee to investigate the possibility of this. Several members of the Executive Committee have been studying the matter and we are now prepared to appoint such a committee and to lay before it a definite plan.

The Board of The Engineering Foundation expected to give consideration at its meeting on October 21, to the Council's application for a continuation of the generous grant of money made to ECPD annually since its establishment in 1932.

WORK OF THE COMMITTEES

The members of the Council will recall that a year ago the by-law providing for the appointment of committees was changed so that the terms of all members of standing committees now terminate at the end of each Council year. This

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Presented at the Sixteenth Annual Meeting, Detroit, Mich., Oct. 29–30, 1948, of the Engineers' Council for Professional Development.

permits reviewing the work of individual members and the reappointment for as many as five consecutive terms of those who have performed effectively. The change is working well in practice and will, I believe, result in the continual strengthening of our committee organization.

A reading of the reports of the special and standing committees of the Council will indicate tangible accomplishment in various phases of the over-all program. I believe special credit is due to the Committee on Student Selection and Guidance, and individually to its chairman, Prof. Carl J. Eckhardt, Jr., for their effective work in preparing and distributing informational bulletins in the form of pamphlets and posters designed for the guidance of high-school pupils in no less than 10,000 communities in every part of the country. This was only one form of distribution made, although undoubtedly an important part of the assistance afforded student counselors of the schools addressed. The report of the Committee on Student Selection and Guidance contains of course a fuller account of this phase of its work.

MEASUREMENT AND GUIDANCE PROJECT

This same committee has sponsored the Council's participation with the ASEE, and the Carnegie Foundation for the Advancement of Teaching in the Measurement and Guidance Project in Engineering Education. On Jan. 1, 1948, the Carnegie Foundation relinquished their part in the responsibility for devising and administering tests under this project. The newly organized Educational Testing Service with headquarters at Princeton University then undertook to continue the testing services pending a more permanent arrangement. On behalf of our Council and ASEE, Dr. A. R. Cullimore, together with Dr. Harry S. Rogers, Dr. Robert E. Doherty, and Professor Eckhardt, made a careful investigation of the best means of carrying on the program of testing, which has developed as one of the important activities in which the ECPD is engaged. Their discussions with Mr. Henry Chauncey who heads the new testing service have resulted in the negotiation of an agreement with Educational Testing Service for the administering of aptitude tests of the Pre-Engineering Inventory and the Engineering Achievement Tests devised for sophomore engineering students. The Pre-Engineering Inventory will be conducted also as a national program available as in previous years to individuals in advance of matriculation. It is hoped that the ASEE will later become a party to the agreement. The arrangement has already been discussed in the governing board of that society and has been referred to their Committee on Selection and Guidance for advice. In the meantime it is expected that ASEE will appoint members to serve with others similarly appointed by ECPD on the Advisory Council contemplated in the agreement with ETS whose duty will be in conference with ETS, to appoint such planning, examination-construction, and review committees as may be desirable.

It should be explained that the Educational Testing Service was organized under the joint auspices of the American Council on Education of which ECPD is a constituent member, the College Entrance Examination Board, and the Carnegie Foundation for the Advancement of Teaching. It carries out in principle the recommendation that the nonprofit testing agencies be consolidated into one service, made in 1946 by a committee of The Carnegie Foundation for the Advancement of Teaching, headed by Dr. James B. Conant.

Under the terms of our agreement, the ETS, in addition to administering the tests as now formulated, will systematically develop the testing procedures as further experience is had with them, and will give much attention to the validation of results.

To place this work on a self-supporting basis it has been necessary to increase the fee charged to participating institutions, from a net of $1 per student tested to $2 per student, and to make a charge of $7 to individuals taking Pre-Engineering Inventory Tests under the so-called national program. To date forty institutions have indicated their intention of continuing to make use of the tests as the ETS will now administer them.

It is a matter of much regret that Dr. Kenneth W. Vaughn, who originated the tests now being used in this program, has not been associated with the work since the Carnegie Foundation withdrew from the project. Dr. Vaughn has generously offered to assist the Council with his advice whenever we shall have need of such help. At the time the old arrangement with the Carnegie Foundation terminated, he had given a great deal of thought to the subject of establishing tests suitable for sophomores in high school. ECPD's contract with the ETS does not include testing at tenth-grade level, although selection and guidance committees at community level see the possibility of great usefulness in tests administered to this age group. We shall need the kind of advice Dr. Vaughn is eminently qualified to give if this program of high-school testing develops.

PROFESSIONAL TRAINING

Under the leadership of the late Scott B. Lilly the Committee on Professional Training, early in the current year, outlined a program for encouraging junior engineers to continue their systematic technical education after graduation from college and to realize on their opportunities for attaining stature in the community as members of the engineering profession. Professor Lilly's untimely death last August has been a grievous loss to ECPD. Although he was appointed to the chairmanship only last October, he had given many indications that a real contribution in this important field of activity would be forthcoming.

We have in fact made only a beginning of carrying this enterprise to the important centers in which first-degree engineers find employment. The Council's role here is to give encouragement to the junior-engineer training movement already being undertaken by a number of national engineering societies. It seems certain, furthermore, that this committee's project of surveying and listing the graduate engineering courses offered to engineers in various industrial areas of the country will prove useful. As stated in the committee's report, President Jess H. Davis of Clarkson College of Technology, is chairman of a subcommittee having this in charge.

There is still another approach to be made in this effort to make the first few years out of college a period in which the engineer may continue his systematic study while experiencing the maturing influence of his first postcollege employment. It is to solicit the comment and advice of the thoughtful employers of engineers. Many large industrial organizations supplement the college training by instituting postgraduation training of their own, but the young engineer employed in less highly organized companies is seldom given such opportunities. Your chairman, for one, is convinced that a local ECPD effort to take counsel with employers will yield results of great usefulness both to the engineer and his employer. It seems not unlikely that such discussions will lead to a more clear conception of the college's responsibility with respect to fundamental engineering teaching and that there will consequently be less insistence upon specialization in undergraduate courses. There can be no doubt of the influence exerted on the educational process by the user of the product, that is, by the employer.

We believe that the Committee on Professional Training will be in competent hands under the chairmanship of Mr. A. C. Monteith, vice-president in charge of engineering, Westinghouse Electric Corporation.

Your chairman recommends to the particular attention of that committee three reports bearing on this relationship between young engineers and their employers. Two are the work of committees of Engineers Joint Council, the first title "Preliminary Survey of Employer Practice Regarding Engineering Graduates," the other a report of the EJC Committee on the 1946 Survey of the Engineering Profession dealing with the economic status of engineers in the period investigated. The former of these surveys, conducted under the chairmanship of Mr. E. G. Bailey, it is planned to repeat on a more comprehensive scale. Both are valuable reference works.

The third report just referred to is that of the Sub-Committee on Student Development, sponsored by the Committee on Engineering Schools. Dr. A. R. Cullimore is chairman of the Sub-Committee. In this is given the results of an investigation of ". . . . . the most desirable personal characteristics. . . . ." in engineers. Opinions were obtained from several different groups—executives, college administrators, engineering faculty members, personnel officers, and college students. The work is of much intrinsic worth and the report itself, of which Chairman Cullimore himself is the author, has, in the opinion of your chairman, no small literary merit. It is witty and readable and displays withal a refreshing appreciation of the fallacies to which a survey of human characteristics is liable, as well as a sincere belief that such research should nevertheless be undertaken.

PROFESSIONAL RECOGNITION

During the course of this meeting I believe the Council should discuss further with its Committee on Professional Recognition[1] their comparative study of grades of membership in ECPD's several constituent societies, aimed not only at more uniform nomenclature but to a higher qualification requirement for entrance to the membership grade. The method by which the societies ought to be approached in this important matter needs careful reconsideration, and I am much inclined to believe that the representatives of these societies on Council must presently be called upon to take an active part in the discussions which will be necessary with the governing boards of their respective organizations. Several of the societies have this matter under active consideration.

CANONS OF ETHICS

Your attention is called to the report of the Committee on Principles of Engineering Ethics in which is described the progress made toward approval of the Canons of Ethics for Engineers by societies other than the eight ECPD constituent societies and toward their incorporation in the by-laws and constitutions of some of these organizations. The committee renews its recommendation that a definite procedure be set up for the amendment of the Canons, which calls for a decision by this Council. It should be noted that The American Society of Mechanical Engineers has included the Canons in their constitution by reference only and has made them a part of their by-laws and therefore the more readily amended.

Thus far, the Committee on Principles of Engineering Ethics has been continued as a special committee, your Executive Committee being reluctant to increase the number of standing committees of ECPD. The question should be discussed and, if possible, a conclusion reached at this Annual Meeting.

COMMITTEE ON INFORMATION

The Committee on Information should be commended for faithful performance of the many tasks assigned to it during the past year. Thanks are due especially to Mr. G. Ross Henninger, until recently editor of *Electrical Engineering*, for his revision of the manuscript of the Manual for Junior Engineers, of which the late Dr. W. E. Wickenden was the author. The question of how this text is to be printed and distributed is being referred to the Committee on Professional Training who initiated and fostered the project.

NATIONAL SCIENCE FOUNDATION

At the last Annual Meeting the Council approved appointment of a special committee to observe and report upon proposed legislation before Congress to establish a National Science Foundation. The chairman appointed Dean A. A. Potter of Purdue University to act as chairman of a committee, the other members of which are: Dr. H. S. Rogers, Dr. Clyde E. Williams, Dean Albert B. Newman, Mr. Nevin E. Funk, Dr. H. P. Hammond, and Dr. Boris A. Bakhmeteff. This committee, working closely with a panel appointed by the Engineers Joint Council, very effectively presented the case for inclusion of engineering research in the provisions of the bill as rewritten, following the President's veto of the act as originally passed. Dean Potter reports that the revised bill does include such a provision and will be reintroduced at the next session of Congress. The special committee of our Council, to which this task was assigned, has not been discharged. Although it appears that the Engineers Joint Council is the body properly responsible for following up a matter of legislation such as this, it is your chairman's recommendation that our committee be continued until the matter is disposed of by Congress, in order to keep this Council informed of the progress being made. I should like to express the Council's thanks to Dean Potter and his entire committee for the promptness and tact with which they have dealt with this assignment.

CITIZENS FEDERAL COMMITTEE ON EDUCATION

Mr. Ralph Goetzenberger has for several years represented ECPD on the Citizens Federal Committee on Education, which is a conference of representatives of groups having national cultural interests, appointed to act in an advisory capacity to the United States Office of Education. He is at present secretary of this advisory group and is therefore in an especially good position to keep the ECPD informed of developments in the fields of education in which the Federal Government is active. He was a member of a subcommittee of the advisory group which examined the report by Dr. Graham of Princeton University. This report "revealed widely scattered and uncoordinated educational activities throughout the Federal Government, some ephemeral in nature, several expedient and several sound, others secondary to the objectives served." Representation on this Citizens Committee provides a valuable source of information for this Council, and I am glad that Mr Goetzenberger finds it possible to represent us. Members of the Council who wish copies of any of the publications of the United States Office of Education or to obtain reports of the Citizens Federal Committee may address their inquiries initially to Mr. Goetzenberger.

Finally, your Chairman wishes to express his thanks to the members of the Executive Committee, for their constant attendance at its bimonthly meetings, and to the members and chairmen of all committees for their very real contribution throughout the past year to the work of this Council.

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[1] See MECHANICAL ENGINEERING, December, 1948, pp. 994–995 and 997.—EDITOR.

BRIEFING THE RECORD

Abstracts and Comments Based on Current Periodicals and Events

Compiled and Edited by J. J. Jaklitsch, Jr.

MATERIAL for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context and credit to original sources is given.

Synthetic-Fuel Industry

THE main problems which the synthetic-fuel industry faces in the United States were discussed by Frank A. Howard, industrial research and development consultant, New York, N. Y., at a recent meeting of the ASME Metropolitan Section, New York, N. Y.

He said that the first problem is that the synthesis processes based on coal and shale are too costly if carried out by the methods proved and used abroad, and the new processes under development here are not yet ready to freeze into plant designs. But the President and Secretaries of Defense and Interior have taken the position that our national defense requires an immediate start on a synthetic-fuel industry. The fact that the 80th Congress seemed to agree made it clear that this was in no sense a political issue. The Republican-sponsored Wolverton Bill, appropriating $350,000,000 for the founding of the new industry, failed to pass last summer only because of pressure of other legislative business.

Mr. Howard believes that in the production of oil from shale the problem seems simplest. He reported that at least two very promising new processes have given satisfactory performance in small-pilot-plant operation. These are the down-draft up-flow internal-combustion retort being pioneered by the Union Oil Company of California, and the fluidized retort being pioneered by Standard Oil Development Company. Either of these two processes, and perhaps some others, could, if the necessity were great enough, be frozen into commercial designs at once, but the more conservative view is that larger-scale pilot-plant tests should first be run to give opportunity to uncover and eliminate latent troubles.

It is true that shale oil is perhaps the worst product the oil industry has ever had to handle but it can be hydrogenated successfully by the high-pressure destructive hydrogenation process and it would be possible to freeze the designs on this equipment at once, he stated.

Mr. Howard then turned from shale to coal. The destructive hydrogenation process is the most highly developed synthesis process in this field and plant designs following the German and English models could be frozen at once, but, he pointed out, gasoline production from coal by this method would need a protection or subsidy which he believed would have to be at least 18 cents a gal. He said that if we had large reserves of very low-ash coal at locations practical for such an industry these costs might be reduced. The most hopeful estimates of coal-hydrogenation costs seem to have been based on the use of coal as low as $2^1/_2$ per cent in ash. Certainly the weight of engineering opinion is that the destructive hydrogenation process is not a broad or economically promising foundation for an American synthetic-fuel industry. On the other hand, the Fischer-Tropsch or hydrocarbon-synthesis process seems very well adapted to American conditions and is the only one being actively developed with private capital. There are two steps in this process: first, the conversion of the coal into synthesis gas, and second, the production of oil from the synthesis gas. It is the first step which seems now to be the critical one and in which development is most active. First there might be mentioned the continuous pulverized-coal gasification pioneered in limited experiments by Koppers in Germany and development of which is now being financed by the Bureau of Mines through the American Koppers Company; second, there is the fluidized process which is favored by the Standard Oil Development–Pittsburgh Consolidation coal group; and third, there is the modified Lurgi process which the Hydrocarbon Synthesis Corporation regards as the one most nearly proved for commercial use with suitable noncaking coals, and which they will presumably use as a foundation in a South African coal-synthesis plant which they are designing.

The processes mentioned are only those which loom up most prominently on the horizon, Mr. Howard pointed out. There are several others which are under development by these same concerns and by others as well. The parents or foster parents of each of these various processes naturally have a somewhat partial view of the status of their own child as regards its availability for immediate commercial use, but Mr. Howard believes that the predominant view is that not one of these coal gasification processes, suitable for wide use under American conditions, has yet reached a stage of development where it should be used as a basis for any such program of governmental

How to Obtain Further Information on "Briefing the Record" Items

MATERIAL for this section is abstracted from: (1) technical magazines; (2) news stories and releases of manufacturers, Government agencies, and other institutions; and (3) ASME technical papers not preprinted for meetings. Abstracts of ASME preprints will be found in the "ASME Technical Digest" section.

For the texts from which the abstracts of the "Briefing the Record" section are prepared, the reader is referred to the original sources, i.e.: (1) The technical magazine mentioned in the abstract, which is on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., and other libraries. (2) The manufacturer, Government agency, or other institution referred to in the abstract. (3) The Engineering Societies Library for ASME papers not preprinted for meetings. Only the original manuscripts of these papers are available. Photostat copies may be purchased from the Library at usual rates, 40 cents per page.

expenditures as is called for by the Wolverton Bill. He warned that from one to two years' more development work should certainly be carried out before any attempt is made to select the most promising process or processes and freeze the designs for the first commercial plants.

But the primary urge back of the governmental pressure for an immediate synthetic industry is the military urge, and if the opinion in executive and legislative circles this month is the same as it was during 1948, the oil and coal industries will face a demand for immediate action of some kind directed toward a synthetic industry.

Mr. Howard suggests, therefore, that we try to agree upon some definite program which can be initiated at once and which will move forward in an orderly way to make the maximum of real progress. As an example of such a program, he proposes that we adopt a time schedule, for example, two years, and within this time schedule undertake to complete the following:

1 A survey of American shale and coal resources from the points of view of their practical availability as a basis for synthetic-fuel plants. It is suggested that this work be done by contract under the supervision of the Army engineers, under general instructions drafted or approved by the Military Petroleum Advisory Board. The cost of this survey might be $3,000,000.

2 The preparation of project plans, including designs and estimates for three shale-oil plants and three coal-synthesis plants, these project designs and estimates to be undertaken by private industrial groups under contract with the RFC. Each project to be based upon a unit of a minimum size of 5000 bbl of oil per day, and to include all data essential for the expansion of the project on the same site or its duplication at other named sites up to a total of 25,000 to 30,000 bbl per day. The designs and specifications for each project to be complete enough to serve as a basis for widespread competitive bidding for construction contracts. This would not require the detailing of engineering work or of equipment of a standardized nature on which competitive bidding could be obtained promptly on general specifications. It is believed that the cost of these six project plans would lie in the range of 10 to 20 million dollars. The companies with whom these contracts for projects were made would presumably be those private concerns best able to plan and execute such projects and operate the completed plants. Each contractor would obligate himself to execute and manage his project, if requested, on a basis substantially the same as that used by the RFC, in connection with the building of the synthetic-rubber industry.

3 The companies now actively developing coal and shale processes would be expected to adapt themselves to the foregoing two-year time schedule. Research and development work could be intelligently planned so that an operative design and process (even though it might not be the best one or the ultimate one) would be available for inclusion within these project designs before the end of the two-year period. It is contemplated that most of the research and development work would continue as at present under private auspices without financial support from the government. This, however, does not exclude the possibility that some concerns wishing to present projects might make arrangements through which government-financed research and development work would be relied upon in part at least, and this would serve the purpose of getting the government work also scheduled for completion up to some useful concrete result within the time limit set. It is no criticism of industrial research and development work, whether government sponsored or privately sponsored, to say that all such work needs, at a certain stage of its progress, to be run against a time schedule.

If the foregoing program were followed, Mr. Howard stated, it would be possible at the end of two years to place immediate contracts for the construction of anything between 5000 bbl per day and 180,000 bbl per day of synthetic fuel from oil and shale. Furthermore, the necessary foundation would have been laid so that if military or other considerations required immediate expansion up to, say, one to two million barrels per day, as has been forecast in some military analyses, there would be available a complete survey of national shale and coal resources on which a master plan for the expansion could be based, and there would be available at least six competent organizations who could be called upon to begin at once the layout of additional projects. Complete designs and technical information would also be available from each of these six concerns for the immediate use of the indefinitely large number of industrial and engineering groups who would have to be brought into the picture to create any such capacity as one or two million barrels per day of synthetic fuel products.

He said that no one can say with certainty at this moment what conditions will be two years hence. Our military authorities seem to believe that we might require very large synthetic production. On the other hand, military or economic conditions at the time might justify no governmental intervention at all or only modest intervention or support. Whether the need is then an emergency need for a great industry, whether conditions have so changed that there seems to be no need whatever for any governmental support of such an industry, or whether we find ourselves in some intermediate position in which there is reason to support a small industry only—under any one of these three cases the adoption of some sort of a rational program, either as here suggested or as may be suggested by others, would seem much more realistic, economical, and sound than an attempt to spend $350,000,000 in the immediate erection of three large synthetic plants based on shale and coal.

Mr. Howard pointed out that it is no secret that the National Securities Resources Board has prepared a long-range program which involves the cutback of oil production in the United States by some large figure —20 per cent has been mentioned—in order to create an immediately available underground reserve against a military emergency. Whether this long-range plan will be found workable or acceptable, in whole or in any part, perhaps is still undetermined. If this plan were to be actually followed, however, it would seem to require that American oil supplies be supplemented not only by greatly increased imports but also by every other practical expedient. He also stated that he could not see how it would be possible to determine at all intelligently the extent to which synthetic production would be a practical expedient to supplement American supplies and to fit into any such long-range plan, unless that decision were based upon some integrated program along the general lines of the one here suggested.

Humidity-Test Apparatus

A HUMIDITY-TEST apparatus, developed and built in the Mechanical Instruments Laboratory of the National Bureau of Standards, now makes available an instrument for research, calibration, and testing of hygrometers at temperatures below freezing.

The function of the humidity-test apparatus is to produce air of known relative humidity at temperatures from zero to minus 40 C. In the new divided-flow low-temperature humidity-test equipment, developed by Arnold Wexler, a current of dry air is divided into two streams, one of which is maintained dry while

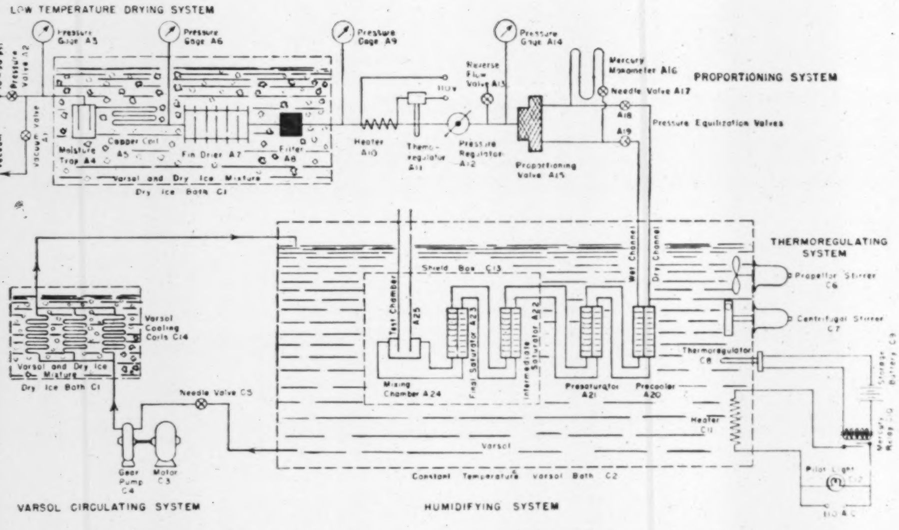

LOW TEMPERATURE DRYING SYSTEM
Air Supply 10–90 psi
Pressure Valve A2
Vacuum
Vacuum Valve A1
Pressure Gage A3
Pressure Gage A6
Pressure Gage A9
Pressure Gage A14
Moisture Trap A4
Copper Coil A5
Fin Drier A7
Filter A8
Varsol and Dry Ice Mixture
Dry Ice Bath C1
110v
Heater A10
Thermoregulator A11
Pressure Regulator A12
Reverse Flow Valve A13
Proportioning Valve A15
Mercury Manometer A16
Needle Valve A17
A18
A19
Pressure Equilization Valves
PROPORTIONING SYSTEM
THERMOREGULATING SYSTEM
Propellor Stirrer C6
Centrifugal Stirrer C7
Thermoregulator C8
Storage Battery C9
Mercury Relay C10
Heater C11
Pilot Light C12
110 A C
Wet Channel
Dry Channel
Shield Box C13
Test Chamber A25
Mixing Chamber A24
Final Saturator A23
Intermediate Saturator A22
Presaturator A21
Precooler A20
Varsol
Constant Temperature Varsol Bath C2
Varsol Cooling Coils C14
Varsol and Dry Ice Mixture
Dry Ice Bath C1
Needle Valve C5
Gear Pump C4
Motor C3
VARSOL CIRCULATING SYSTEM
HUMIDIFYING SYSTEM

FIG. 1 DETAIL SCHEMATIC DIAGRAM OF THE HUMIDITY-TEST APPARATUS SHOWING ITS FUNCTIONAL UNITS AND COMPONENT PARTS

the other is saturated with respect to ice; finally the two are recombined.

A proportioning valve is used to divide the flow of moisture-free air in a known ratio. One part is passed through a saturator over a series of trays containing ice, until it is completely saturated. It is then mixed in a mixing chamber with the other part that has been maintained dry, and allowed to exhaust through a test chamber into the atmosphere. The saturator, mixing chamber, and test chamber are kept immersed in a constant-temperature bath. The hygrometer or other device, which is being subjected to air of known and constant humidity, is inserted into the test chamber.

The relative humidity in the test chamber is a function of: (*a*) the fraction of air that passes through the saturator, (*b*) the total pressure in the saturator, (*c*) the total pressure in the test chamber, (*d*) the saturation pressure, and (*e*) the partial pressure of the water vapor in the test chamber. Under ideal conditions, which the apparatus closely approaches, all variables except one are eliminated, and the relative humidity becomes equal to the fraction of air that passes through the saturator.

The essential functional units of the apparatus are the drying system, the proportioning system, the humidifying system, the mixing chamber, the test chamber, the cooling system, and the thermoregulating system for temperature control.

The drying system serves to remove all water from the air entering the apparatus by freezing in a dry ice-varsol bath. The dry air then passes through the proportioning system, the major feature of which is the proportioning valve. This valve, which divides the air in a definite ratio, consists of six orifices of equal cross-sectional area so arranged that by a turn of the knob of the valve the incoming air can be divided to produce any of seven ratios, 0, $^1/_6$, $^1/_3$, $^1/_2$, $^2/_3$, $^5/_6$, and 1. The ratio is the fraction of air entering the valve that emerges through one exit channel.

The two air streams, upon leaving the proportioning system, flow through the humidifying system in parallel channels, thermally in contact with one another to allow heat interchange and temperature equilibrium between the two streams. Saturation of one stream is accomplished by allowing it to pass over a series of staggered ice-filled trays while the other stream passes over an identical path of dry shelves. The dry and saturated air are centrifugally mixed in a mixing chamber and discharged into the atmosphere through a $1^1/_8$-in-ID tube that serves as a test chamber. The saturators, mixing chamber, and test chamber are immersed in a bath whose temperature is closely regulated.

The over-all performance of the humidity-test apparatus has been established by a series of gravimetric moisture determinations. For the temperature range of zero to —40 C and for air velocities up to 1500 fpm, this instrument produces air whose relative humidity is known within 3 per cent.

While particularly suited for the investigation and calibration of hygrometers, psychrometers, and development apparatus at temperatures below 0 C, the humidity-test equipment may find further application in general research and testing where air of a known low dew point or moisture content is desired.

Although this instrument was designed primarily to fill a basic need in meteorology, the refrigeration and air-conditioning industries may also find it useful.

Spectroscopic Metal Analyzer

RAPID differentiation between various grades and detection of residual elements in stainless steels at the Wood Works of Carnegie-Illinois Steel Corporation are now effected by spectroscopic methods. This United States Steel Corporation subsidiary plant has found the procedure valuable for making rapid and accurate qualitative determinations, especially in identifying stainless-steel grades which owe their identity to one or more modifying elements. These elements include the columbium of type 347, titanium of type 321, molybdenum of type 316, copper, and molybdenum of type 315, and others. Semiquantitative estimates from visual or photographic examination are possible for some elements common to stainless steel when they are present in small percentages. This makes possible, for example, such separations as type 410 twelve per cent chromium steel from type 405 twelve per cent chromium steel containing aluminum.

The spectroscopic metal analyzer used consists of a fixed-deviation glass-prism spectrometer mounted on a portable cabinet. The visible range of the spectrometer extends from 4000 to 8000 Ångstrom units, which is the visible range of the spectrum. This range may be increased slightly by the use of photographic attachments.

The arc stand is versatile with respect to the size of sample it will accommodate, and is contained in a housing with a safety switch on the door jamb to facilitate rapid changing of samples and to permit these changes to be made without danger to the operator. The arc functions on 220 volts direct current. Resistances are housed in the cabinet to provide a selection of currents ranging between 4 and 10 amp.

Desired portions of the spectrum are brought to the center of the field by rotating the prism table with a micrometer screw coupled to a calibrated drum. The cross hairs are superimposed on the field at a wave length that coincides with the wave length of each element common to stainless steels, marked on the drum. Photographs of spectra are made with a camera attachment. It consists of a lighttight box fitted tightly around the eyepiece of the spectroscope, with a photographic plateholder attached to the opposite end. It is possible to photograph several spectra on a single plate.

One of the useful applications of the instrument is to confirm the grade of hot-rolled plates as received at the mill before any further processing. This avoids costly processing of the wrong grade to sheet product. All orders for stabilized grades are checked for the presence of the proper stabilizing element, and all orders for Type 405 twelve per cent chromium steel are checked for the presence of aluminum before shipping.

Some contaminating elements picked up by steel in service may be quickly detected.

Commercial Electronic Computer

AN office-size electronic computer capable of solving intricate industrial and research problems is now available commercially. Called the REAC (Reeves Electronic Analog Computer) by its designers, it was developed by the Reeves Instrument Corporation for the Special Devices Center, Office of Naval Research. Realizing the value of this instrument to industry, the Navy has released it from its list of classified material.

It is claimed that the REAC will meet the growing need for a reasonably priced, commercially available, high-speed electronic differential analyzer. It is said to make possible mathematical explorations into fields of scientific analysis that have been formerly economically unfeasible.

The REAC is reported to have found extensive use in the following fields of engineering research: Electrical circuit analysis, automotive engineering, aircraft engineering, internal-combustion engines, electron dynamics, control systems, vibration analysis, and hydraulics.

It may be used for the speedy dynamic solution and analysis of simultaneous differential equations. As a simulator, it may be used to actually check the design characteristics of a new machine or system to evaluate the allowable range of design parameters, thus eliminating expensive trial-and-error methods. As a tester, it may be used to check equipment to determine whether or not its design will meet actual field conditions.

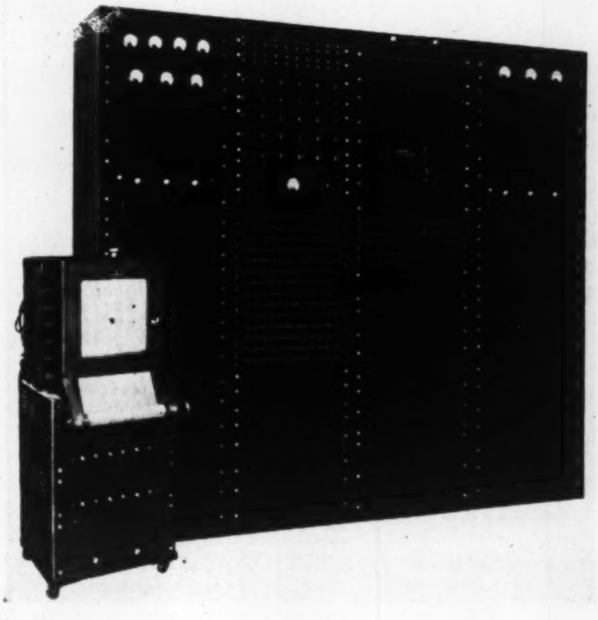


FIG. 2 COMMERCIAL HIGH-SPEED ELECTRONIC COMPUTER

According to the company the REAC will solve with a high degree of accuracy any initial valued differential equation up to the seventh order. Two or more REAC's may be interconnected to handle problems of higher order. A servomechanism unit may be added to increase the scope of the REAC to provide for vector resolution and vector addition. It will also multiply and divide arbitrary functions made possible by special functional potentiometers.

Extensively used in the solution of industrial-research problems, the REAC is said to have set a record for timesaving that is amazing even to its designers. A typical problem which was estimated to require 2949 man-days by trained mathematicians using hand methods was solved with the aid of the REAC in 108 man-days. Cost of machine solution was $3240 whereas estimated cost of computation by old methods was $73,725. The difference in the cost of the solutions in this one instance is much greater than the cost of the REAC, which is approximately $33,000.

The REAC is an all-electronic computer consisting of twenty electronic amplifiers for summing and integrating. Initial conditions and problem variables are set in on vernier dials that are connected to precision potentiometers. The problem is "set up" by means of telephone-type patch cords that interconnect the various amplifier inputs and outputs. The final solution is recorded on a six-channel recorder.

Operation of the computer is said to be very simple. An engineer or mathematician can learn in a few days how to set up and solve all types of problems. Maintenance is also kept to a minimum by the use of standard high-precision radio parts.

Industrial Diamonds

THE use of diamonds by industry received a great boost during the recent war, and the applications for industrial diamonds are being broadened constantly, according to an article in *The Frontier*, September, 1948, by Frank M. MacFall, associate engineer, Armour Research Foundation. To meet the increased demand, new methods of preparing industrial diamonds are being developed which are resulting in much lower initial costs and longer life of tools in which the stones are used.

Diamond powder, the basis of the new sintered diamond tools, is being graded more uniformly and accurately and is being offered in more convenient forms. Several new industrial applications of the diamond have been developed and show great promise in their respective fields.

Mr. MacFall reports that one of the newest and most important developments in the industrial-diamond field is the electrical method of drilling diamond dies. These dies, which consume about 10 per cent of all industrial diamonds used, are for drawing tough chrome-nickel and phosphor-bronze wire to a uniform diameter and in the production of copper wire in sizes below 0.080 in. in diam. Diamond dies are indispensable wherever precision of gage or perfect roundness is necessary. The new method, worked out by the U. S. Bureau of Standards, will result in the production of diamond drawing dies at a fraction of their former cost. See "Diamond Die Drilling," Mechanical Engineering, May, 1947, p. 416.

Another recent development cited by Mr. MacFall in diamond tools is the diamond band-saw blade developed by the DoAll Company. This saw consists of cylindrical segments composed of diamonds bonded in sintered tungsten alloy matrix. These segments are brazed in position on the tooth of the band.

Three basic tooth designs are available based on the pitch of the blade—the pitch being the number of segments per foot. The 24-pitch blade is suitable for cutting materials up to two inches thick, while the eight-pitch is recommended for work over two inches thick, and a one-pitch blade is available for cutting very thick work sections. The kerf is about $^1/_{16}$-in. wide. The space between the tooth and gullet is designed to attract coolant and with the diamonds throughout the cylindrical matrix some lateral cutting is possible which is advantageous on small radii.

The greatest advantage of the diamond band saw is its ability to do contour sawing so the material removed is salvageable. This is especially applicable where valuable materials or alloys are being cut. Cutting rates are fast, as $^5/_8$-in. hardened steel dies can be cut usually at a rate of $^1/_{10}$ sq in. per min while pieces of tungsten carbide can be cut at about half that rate. Glass up to 8 in. thick can be cut at a rate of about 3 sq in. per min.

Another new application of the industrial diamond, quite important in the field of nuclear physics, is as a radiation counter. The diamond is highly sensitive to gamma rays and, like the Geiger-Muller counter, can be used for the detection of these rays. See "Diamond Radiation Counter," MECHANICAL ENGINEERING, December, 1947, p. 1029.

The Bell Telephone Laboratories announced recently the successful development of an electrical amplifying unit employing a diamond. Electron pulses of the order of 15,000 electron volts, and of about one millionth of a second duration are beamed at the diamond crystal. Under their influence, electrical currents are produced within the diamond and these may be several hundred times as large as the current in the original electron beam. Amplifications up to 500 times have been produced in the laboratory.

Diamonds used are about $^1/_4$-in. square and 0.020 in. in thickness. Electrical connections are made by a film of gold less than 0.00001 in. thick, evaporated on the two surfaces of the stone. Ordinarily tiny imperfections in the stone will trap electrons and tend to choke off the current produced, but this defect has been overcome by applying a 120-cycle alternating current to the diamond which cancels out the trapped charges.

It is thought that the induced currents are produced in as short a time as one ten millionth of a second, which would make the application suitable for amplification of the high frequencies encountered in telephone transmission.

Color Vision Advances

A NEW polychromatic theory of vision, which is an attempt to combine the best features of Young's three-color theory and Hering's four-color theory, was advanced recently in an address delivered by Prof. H. Hartridge, president of Section 1 (Physiology) of the British Association for the Advancement of Science, at a meeting of the Association at Brighton, England, and printed in *Science*, Oct. 15, 1948.

Until recently, the article states, experimental work appeared to support unequivocally the three-color theory of Thomas Young, but further facts became apparent which were incompatible with that theory. These facts were as follows: (1) The change in the shape of the luminosity curve with reduction of light intensity, and the development of a notch; (2) the corresponding change in the shape of the luminosity curve with reduction of visual angle; (3) the finding by the author of more fixation points in the fovea than three; (4) the finding by the author of more specific colors than three. These results, which were incompatible with the three-color theory, led to a re-examination of the whole subject of color perception. Professor Hartridge discusses the polychromatic theory, hue discrimination, tristimulus spectral mixture, the retinal direction effect, peripheral vision and reduced foveal vision, the constancy of white, the effects of light intensity, adaptation, and visual angle on foveal spectral mixture, selective adaptation, saturation discrimination, the antichromatic responses, the fixation points, and the subjective colors, and some other receptor arrangements. The article also contains three tables to illustrate the material, plus a list of references.

In conclusion, the author says that modern requirements are met by a polychromatic theory, comprising seven types of receptor, but there is no necessity for these to have such narrow spectral response curves as those exhibited by Granit's modulators. Modifications of the three and four-color theories have been examined to see to what extent they can be made to fit in with experimental results. There must be polychromatism throughout the entire visual mechanism for color perception if a complete account is to be given of all the known facts.

Coal-Burning Locomotives

AN article in *Bituminous Coal Research*, July-September, 1948, points out that intensive promotion of Diesel-electric as the ideal form of railroad motive power and resulting purchases by the railroads of this type of locomotive have produced in the public mind the idea that coal-burning locomotives are outmoded and impractical, and are being discarded as a form of motive power. The situation is, instead, according to the article, that current and planned progress in locomotive design lays considerable emphasis on coal-burning types and the offspring of the "old iron horse" make up an impressive herd for the nation's tracks.

The basic economics of initial cost and maintenance, the range of available sizes of the reciprocating steam locomotive for various jobs and terrains, and the fact that 30,000 of them are in operation on the nation's railroads, will keep it in the motive-power picture for a long time, the article states. In addition, recent modernization programs on several roads have produced new designs of reciprocating steam locomotives that permit performance never before achieved by this type, and two new types of coal-burning locomotives have been developed in the form of the direct gear-driven steam turbine and in the steam-turbine-electric locomotives. All these are in operation and are said to be performing to the satisfaction of the designers and the railroads.

But beyond these, it is revealed, there are being developed other types of coal-burning locomotives with new design and operating cost possibilities that are expected to solve or eliminate many of the problems in existing steam, Diesel-electric, or electric motive power. Under development, and accorded by motive-power men to have excellent prospects of being successful, are the coal-fired gas-turbine locomotive and a high-pressure high-temperature steam-turbine-electric locomotive. Also, a gas-turbine-electric locomotive that will be fired initially with a liquid fuel is being developed with the hope that it will evolve into a coal-burning locomotive with the consequent economy in fuel costs.

Although most of this work is being done by railroads and the coal industry, some of the development is being pursued by manufacturers convinced by the economics of the coal-oil situation and operation and maintenance characteristics of new and proposed locomotive types that railroad prime movers will be fired as they have been in the past, primarily with coal.

The article reports that the Diesel-electric is really an electric locomotive with its own Diesel power plant. Although possessing advantages over the old type of reciprocating steam, it still has two characteristics which motive-power engineers would like to eliminate; it still has reciprocating parts with their ensuing stresses and wear and it still uses water. Although the quantities of water are smaller than for reciprocating steam, the problem of supplying clean water and eliminating solid deposits therefrom are no less important to the Diesel-electric's operation than to the steam locomotive's.

The electric locomotive, deriving its power from stationary plants, eliminates these shortcomings but the greatest deterrent to electrification of railroads is the expense of power transmission lines and overhead.

Recent progress on coal-burning locomotives has produced the steam-turbine-electric and the direct-drive steam-turbine locomotives, neither of which has reciprocating parts.

The steam-turbine-electric exemplified by the Chesapeake and Ohio "500" will travel at 100 mph and provides high tractive effort on grades and high horsepower for the long level stretches of track. See MECHANICAL ENGINEERING, November, 1947, p. 941.

A very recent project in the steam turbine-electric locomotive field is the Westinghouse program to develop a compact high-pressure high-temperature steam turbine-electric locomotive The production of this locomotive by Westinghouse and Babcock and Wilcox will draw on the knowledge gained in the development of the C & O "500" and the Pennsylvania S-2 direct-drive steam-turbine locomotive, projects in which Westinghouse was active.

Utilizing the proved performance of the turbine in stationary and marine installations, the Pennsylvania Railroad, Baldwin, and Westinghouse produced the direct-drive (geared-drive) steam-turbine locomotive. In the three years of its service its performance in hauling high-speed freight and passenger trains has proved satisfactory.

Motive-power men largely agree, however, that the gas-turbine locomotive most closely approaches the ideal type because it is a relatively simple prime mover. Here again is the attempt to produce an electric locomotive carrying its own power plant which will burn coal, the fuel of assured future supply.

This project of Bituminous Coal Research, Inc., national research agency of the bituminous-coal industry is sponsored by 9 railroads and 5 coal companies.

The coal-fired gas-turbine locomotive eliminates existing locomotive problems of reciprocating parts and the use of water. It requires no boiler. Designers say that it will be cheaper to construct than a Diesel and will require less maintenance. An important advantage of the coal-fired gas-turbine locomotive is the high thermal efficiency with which it can utilize our huge bituminous-coal reserves.

Because compression, burning, and expansion of gases are handled in separate phases, operation of the entire locomotive is simplified. Since the gas turbine has a net gain in power output in cold weather the locomotive capacity is not sacrificed by the production of heat for passenger-car heating.

In addition to these characteristics, it is expected that the coal-fired gas-turbine locomotive can be constructed in a wide range of sizes to suit the needs of specific railroads.

This locomotive, when perfected, is expected to play an important part in counteracting the loss in the last few years of coal tonnage formerly used by the railroads, and it is expected that application of the coal-fired gas turbine for power production in stationary plants will be accomplished in the rather near future with a resultant increase in coal tonnage in that field.

It should be realized, however, the article points out, that a research and development program of the magnitude of the coal-fired gas-turbine locomotive will normally require a number of years from its inception before the perfected machine reaches a point of commercial acceptance. Progress up to this time indicates that the various problems will be solved and that the program is on a normal expectancy schedule.

Crash Injury Research

DURING the past five years the Crash Injury Research project of Cornell University Medical College, New York, N. Y., has studied the causes of serious and fatal injuries in more than 600 survivable aircraft accidents. Data for the study have come principally from accidents in small airplanes. It was assumed that crash forces sufficient to cause serious or fatal injury in small ships were equivalent to forces causing similar injuries in larger ships.

As a result of accident-injury studies this Cornell group has arrived at a limited but useful understanding of the causes of crash injuries and has been able to suggest changes whereby the chances of crash survival in civil aviation have been somewhat increased.

However, this lack of multi-g research facilities for studying the mechanics of structures and the mechanics of the human body under heavy dynamic loads has left an important part of aviation's safety problem completely unexplored.

The universal lack of knowledge of the forces present in crashes make interpretation of accident-injury details difficult.

All cases of survival in serious accidents give valuable evidence that the body can tolerate the force of accidents that wash out small ships and, with regard to the "strength of the body," it is highly significant that more than 50 per cent of the wash-out crashes in private flying today are survived—despite the almost complete lack of knowledge of structures and forces which would allow greater protection by design.

The Crash Injury Research project and all groups concerned with the future safety of flying have a deep interest in multi-g acceleration-deceleration facilities, for such facilities will permit research on the basic factors governing chances of safety in severe crack-ups such as: (1) Energy absorption by structure; (2) tolerance of force by the human body; and (3) optimum relationships between the human body and surrounding aircraft structure under conditions of crash force.

Little can be done to provide optimum protection in crashes until research is undertaken on the following: (1) To determine whether complete fluid support will allow a man to tolerate brief decelerations in the order of 50 to 100 times the force of gravity without material discomfort; also, to what extent a prone, supine, or sitting position affects tolerance of force under conditions of perfect "force-pressure distribution;" (2) to find in what position and to what extent full support of the body by a transparent plastic sheet, netting, improved harness, or "cell" will provide multi-g protection; (3) to find whether, under "ideal" conditions of support, abruptness of loading is an important factor in bringing on the threshold of discomfort or injury; (4) to study the kinematics of the human body when subjected to heavy snubbing action by safety belts in order to find whether the head is accelerated with regard to surrounding structure in aircraft accidents; (5) to determine by study of the kinematics of the body whether the head overtakes structures such as instrument panels, seat-backs, etc., in a crash before these structures have come to a stop so that expected accelerations and relative velocities between the head and adjacent structure can be calculated in designing aircraft installations which will provide maximum protection; (6) to ascertain whether survivable crashes consist of a series of brief impulses or a sustained deceleration and the effect these impulses and decelerations in aircraft structure have on loads that are transmitted to occupants of a ship by safety belts and shoulder harness; (7) to record the relationships of stretch in safety belts and harness to that of the body so as to allow judgment in placing instruments and dangerous structure (so far as is practical) "beyond normal range of the head;" (8) to study the effects of abrupt loads on semifluid, semielastic masses; (9) to find how the kinetic energy of semifluid, semielastic mass is applied to structure to cause damage or destruction of strongly built structures without material damage to the mass; (10) to determine what materials and which types of construction in wings, landing gear, and forward sections provide maximum energy absorption during collapse and thereby cushion the cabin and protect its occupants.

Today almost nothing is known about energy absorption and crash force. A large program of research on structures and materials must be undertaken before engineering data can be made available to increase crash protection.

Seismic Oil Exploration

THE Institute of Inventive Research of San Antonio, Texas, announced recently that a new method of seismic oil exploration has been developed by Dr. Thomas C. Poulter, associate director of Stanford Research Institute, Palo Alto, Calif.

Emphasizing that the research program had not been completed, Dr. Poulter explained that his method in one form employs a pattern of small specially shaped charges of explosive compositions which are detonated above the ground as contrasted with conventional methods of firing a single large charge in a shot hole at various depths beneath the surface.

In discussing the method he disclosed that it usually produced the same, or in many instances better, seismic records than present procedures, and that it employed the identical seismic recording equipment now generally in use.

Relating that his first work along this line was carried out in the Antarctic while he was second in command and scientific adviser of the Byrd Antarctic Expedition of 1933–1935, Dr. Poulter said the above-ground explosion method had been tested and checked against records obtained by conventional methods in both proved and unproved areas of Texas, Oklahoma, and elsewhere.

In the new procedure, charges in the explosive pattern are set up on stakes relatively close to the ground and spread in a hexagonal design of 7, 13, or 19 points, with one in the center, over a selected location. Depending on the type of records sought, comparatively light charges are placed from 5 to 85 feet apart and detonated simultaneously.

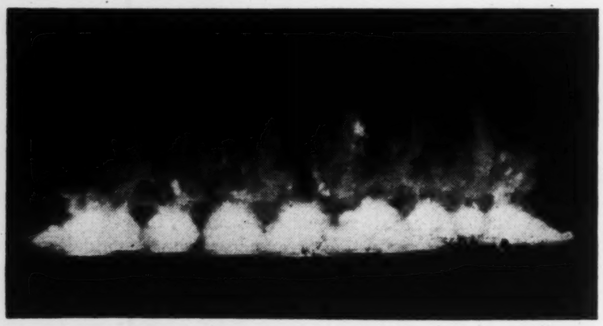


FIG. 3 PHOTOGRAPH SHOWS NIGHT EXPLOSION OF 13-CHARGE DETONATION COVERING 120-FT AREA

Tests have shown the above-ground explosion method, on which patents have been applied for, does not incur the risks of the shot-hole method as regards damaging near-by structures of concrete or other solid material. It also eliminates the danger of falling stones. The Poulter method, however, produces a louder explosion than the shot-hole method, although its concussion effect is almost negligible.

Dr. Poulter pointed out that although the method is an outgrowth of observations first made in the Antarctic, this project has involved many fundamental studies. It was found that when explosives were placed in shot-holes, a major portion of the energy was absorbed within one or two feet of the explosive charge and that the shock wave radiating from this charge had a spherical wave front which was subject to rapid attenuation in addition to the absorption. This explosion also is accompanied by a surface wave or "ground roll" which is troublesome from the standpoint of instrumentation and damaging to surface structures.

It is reported that the new method may be used to produce an essentially flat wave front of low amplitude over a relatively large area, thereby reducing the amplitude of the wave motion in the ground to the point where the wastage of energy is extremely small. The method also includes the use of special shapes and arrangements of charges enabling clear reflections to be obtained even under conditions where reflections are difficult to obtain using ordinary techniques.

Sheet and Tin Mill

THE official opening on October 21 of the new cold-reduction sheet and tin-plate mill at the Pittsburg, Calif., plant of Columbia Steel Company, western subsidiary of United States Steel Corporation, marks the addition of more than 300,000 net tons annually to the supply of quality steel products made by West Coast steel plants for western industry.

Inauguration of this new mill, said to be the most up to date of its kind in the country, is part of the program of additions and improvements launched by United States Steel after V-J Day, which involves an expenditure program of more than $130,000,000 in the west and in excess of $850,000,000 throughout the whole country.

The Geneva, Utah, plant purchased by United States Steel from the Government on June 19, 1946, will play an important part in the present and future growth of Columbia Steel Company's facilities on the West Coast. Upon completion of the current conversion of the Geneva plant to peacetime output, the Pittsburg, Calif., plant will receive hot-rolled coils of semifinished steel from Utah for processing into cold-rolled sheets and tin plate.

Addition of this new rolling capacity on the West Coast will, in fact, make a substantial amount of California-made steel formerly utilized in hot-rolling operations available for increased production of numerous other products such as nails, wire rope, barbed wire, and other wire mill products; for merchant bars, reinforcing bars, and bar shapes.

New production units at Columbia's Pittsburg sheet and tinplate mill include a continuous pickling line; a five-stand, tandem, four-high cold-reduction mill; two electrolytic cleaning lines; 10 rectangular annealing furnaces which can be moved by overhead crane to 30 different bases; two two-stand, tandem, four-high temper mills; a single-stand four-high sheet-temper mill; and modern side-trimming and shearing lines.

Tin plate is produced by the following two methods: Hot-dip tinning for which there are 14 independent lines with mechanical assorting, reckoning, and piling lines; and electrolytic tinning on a continuous plating line which includes mechani-

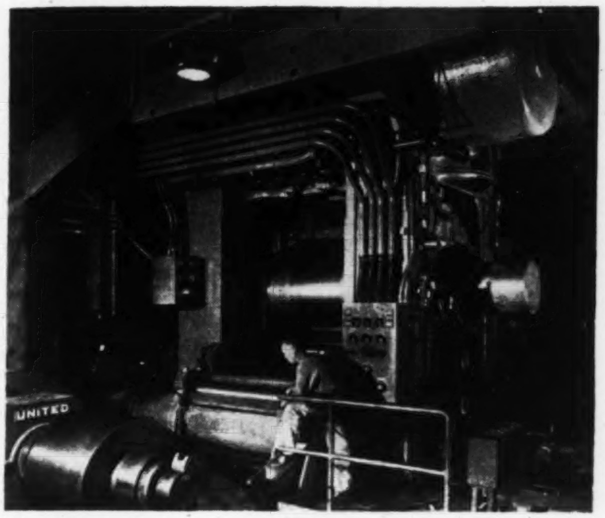


FIG. 4 EXIT SIDE OF SINGLE-STAND FOUR-HIGH SHEET-TEMPER MILL

(This mill is driven by a 1000-hp 600-volt direct-current motor, with a maximum operating speed of 600 rpm. Steel can be rolled at speeds up to 1000 fpm in coil form. Special auxiliary equipment makes possible the temper-rolling of individual sheets when desired. This mill can roll products up to 52 in. wide.)

cal assorting, reckoning, and piling facilities. There is also a sheet-galvanizing line. Modern materials-handling equipment, such as roller and belt conveyers, and various-sized lift trucks, are used.

Plastic Bone Replacement

THE most satisfactory substitute for human cartilage and bone for use by plastic surgeons in repairing damage caused by accidents, burns, and facial deformities has been discovered in a relatively new plastic material known as Bakelite polyethylene, according to Doctors L. R. Rubin, G. W. Robertson, and R. H. Shapiro in the *Journal of Plastic and Reconstructive Surgery*.

Advantages of polyethylene in reconstructive surgery opens a wide field of new applications for this material which is also used in insulating the coaxial cable of radar and television, the manufacture of lightweight nonbreakable bottles and containers, the packaging of food and other articles, bathroom glasses, ice-cube trays, and many other household and industrial items.

Although polyethylene has one of the simplest chemical formulas of all plastics, its commercial production is extremely complex. Perfected commercially by Bakelite Corporation during the war, the entire national output was consumed by the Navy in the construction of radar and other special electrical equipment.

The material is chemically inert and resistant to most common solvents. It has no adverse effect on body tissues nor is it in turn affected by them or by normal temperature ranges. Its natural flexibility and pliability remain unchanged yet it forms a secure scaffolding on which surgeons can build final shapes needed to repair deformities. It will not warp nor dissolve, becomes adherent rapidly, resists displacement, and produces less postoperative reaction than human cartilage or bone.

In describing the technique of using the new material, the article explains that rough forms of the features to be reconstructed are either cut from solid blocks of polyethylene or cast in molds. In the operating room, minor adjustments in size and shape and contour may be made by use of dental stones and burs. Thus exact structure may be obtained in the course of the surgical procedure. The surfaces of the material are roughened to allow better adhesion to tissue (the outer skin with which the plastic implants are covered). When large segments are employed, multiple holes are drilled to permit fibrous ingrowths which give additional fixation.

Only chemically pure polyethylene has been used in surgery.

Freshman Aptitude Tests

AFTER some years of preliminary experimentation with carefully selected freshman test groups, a tentative aptitude battery was given to all entering Yale freshmen in the fall of 1938, according to A. B. Crawford and P. S. Burnham in *The Yale Scientific Magazine*, October, 1948. With successive modifications thereafter, based upon a yearly analysis of results obtained, a similar set of tests has been regularly administered immediately upon matriculation.

With few exceptions, all entrants had earlier taken the College Entrance Examination Board's Scholastic Aptitude Test, which was accordingly utilized to appraise verbal facility. Other tests were anchored to that index.

The battery used with Yale freshman comprises the following elements: (1) Verbal facility; (2) linguistic aptitude; measured by an artificial language test; (3) verbal reasoning; logical inference, deductive judgment, etc.; (4) quantitative reasoning; ability in manipulating hypothetical quantitative data so as to perceive relations or principles characterizing them, and derive laws analogous to, yet different from, those actually encountered in study of the natural sciences; (5) mathematical aptitude, from the College Board Mathematical Aptitude Test; (6) spatial visualizing; representation of three-dimensional forms by two-dimensional figures through projections, block-counting, etc.; (7) mechanical ingenuity; problems in gear-pulley movements, structural stability, and mechanical operations.

Aptitude, as herein defined, represents facility in new application of earlier achievements, rather than a differential capacity so inherent and fundamental as to be little affected by past experience or formal learning. Impact of the latter varies considerably among the seven more or less disparate major areas which this battery attempts to cover.

Portraying an individual's aptitude-test scores in profile form makes it possible for his counselor to evaluate relative promise for various upper-class major fields.

The contrast in relative aptitudes between pre-engineering and prospective academic students seems rather clearly revealed. To what extent particular emphases in preparatory training produced or accentuated these differences is indeterminate. However, secondary school and entrance examination procedures underlying the process of selective admission to certain colleges have usually placed far more emphasis upon common requirements for all students in the basic school subjects than upon individual differences in relative promise for quite disparate upper-class concentration areas.

Achievement tests are probably superior to other instruments when the individual has been adequately exposed to the particular subjects they test, and thereafter when prognosis of sequential higher-level performance within the same or related fields is sought.

British Automobile Show

THE 33rd International Motor Show, the first since 1938, was held in London, England, between October 27 and November 6, 1948.

According to British Information Services, an estimated half-million people visited the exhibition, which was housed at London's Earl's Court. The main feature of the display was 280 automobile models, the vast majority being the latest cars of 32 British manufacturers. In addition, 12 American, six French, and one Italian makes were on view. American cars which drew big crowds were the Kaiser and Frazer, which had not been seen before in Britain, and the new Studebaker Champion. Exhibits of Buick, Cadillac, Chrysler, Chevrolet, Dodge, Hudson, Lincoln, Oldsmobile, Packard, and Pontiac models likewise aroused wide interest.

Britain's own wares revealed considerable changes in design. The new models are larger and faster than the small British cars. Foremost among the models displayed were the Austin A.90 Atlantic and A.70 Hampshire, the Vauxhall Velox, Standard Vanguard, and Jaguar two-seater sports car.

Largest and most expensive was the Daimler Straight Eight at $16,480; tiniest, the Ford Anglia.

For the British public, the show was pretty academic. Three fourths of Britain's annual motorcar output, now running at about 320,000 units, is earmarked "for export only"—as compared with the industry's average of 20 per cent exports before the war.

Since the end of World War II, Britain has exported 400,000 cars, worth £100,000,000 ($400,000,000). In addition, 154,000 commercial vehicles earned a further £70,000,000 ($280,000,000) in foreign markets. During the first nine months of 1948, nearly £44,500,000 ($178,000,000) has been earned by motor exports.

The United States is now Britain's second largest automobile customer. During the first nine months of 1948, Americans bought nearly 16,000 British cars, at a cost of about $14,800,000. Before the war, the United States never imported more than 1100 British cars in any one year. Australia ranks first as an importer of British cars, with nearly 40,000 in the same period.

While the British motoring public must wait between 12 and 30 months for the first delivery of new models, overseas buyers at the Motor Show were, in nearly all cases, guaranteed consignment by the end of 1948.

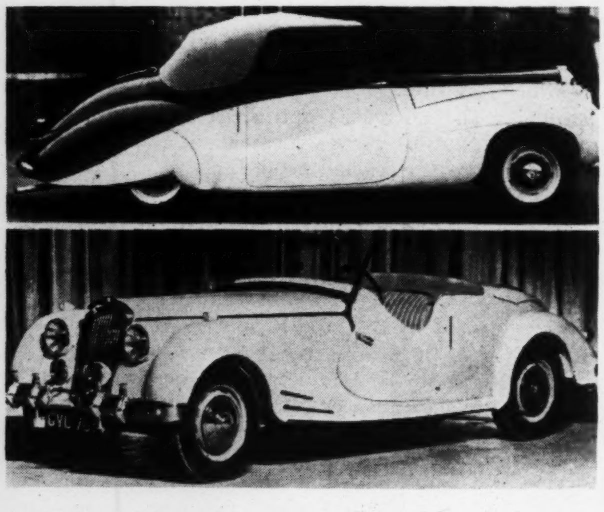


FIG. 5 NEW SPORT CARS AT INTERNATIONAL MOTOR SHOW
(*Top:* 2$^1/_2$-liter Daimler special; *bottom:* 2$^1/_2$-liter three-seater Riley tourer.)

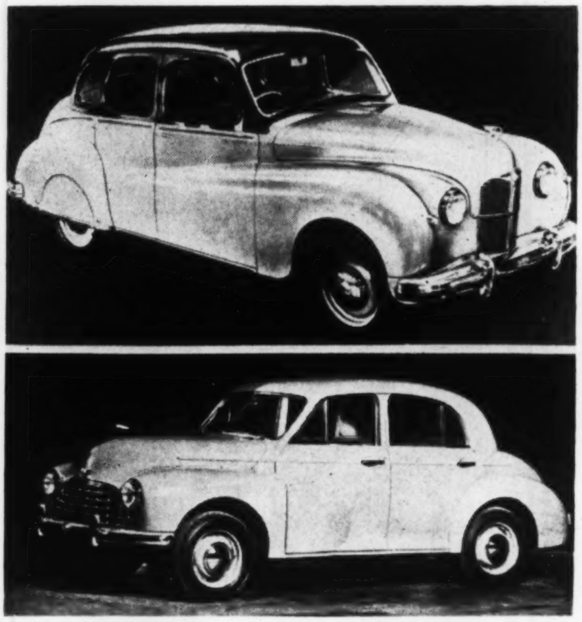


FIG. 6 NEW SEDANS AT INTERNATIONAL MOTOR SHOW
(*Top:* Austin A.70 Hampshire saloon; *bottom:* Morris Oxford sedan.)

Dry Plating

A PROCESS of metal plating by means of a gaseous medium has been developed by the Commonwealth Engineering Company, Dayton, Ohio. Heat is the sole means of deposition in the gas-plating process, which involves the thermal decomposition of metal carbonyls in an inert atmosphere of carbon dioxide.

Objects to be plated are radiant-heated in a plating chamber supplied by a metal carbonyl generator, in a closed system which recycles the plating gases for economy of operation.

An integral metal coating is quickly obtained at temperatures of approximately 400 F, and the "dry" process is applicable to any material which will withstand this temperature range.

Rate of uniform deposition is said to be far higher than that of conventional electroplating, and irregular surfaces, complex shapes, and articles with internal areas are readily handled.

The process is said to be ideally suited to the continuous plating of strip moving at fairly high speeds. In a laboratory-test operation utilizing a small experimental unit, 13 lb 6 oz of nickel was deposited in a 60-min, single-pass plating cycle. In another operation on continuous strip, it was claimed that an amount of metal which would have required 30 min to apply by conventional plating methods was deposited in four seconds. Thus a web of fine hard paper moving at a substantial speed can be readily coated by the gas-plating method, opening up new possibilities for the production of foil laminates, can-making materials, and condenser papers.

Metal strip may likewise be gas-plated at high speed without the high heat requirements and extensive equipment required by conventional thermomechanical methods.

Carbonyls of a number of metals, including nickel, iron, chromium, tungsten, and molybdenum, may be used in the process. Surface preparation for gas plating is the same as for electrolytic plating.

Control of the process is relatively simple, however, without the complicating factors of complex baths, delicate solution balances, and intricate electrodes presently involved in wet plating.

Recording Vibrometer

MECHANICAL vibrations in moving machinery are recorded on waxed tape by a new recording vibrometer developed by the General Engineering and Consulting Laboratory of the General Electric Company. This instrument to facilitate vibration analysis is useful over a range from 10 to 120 cps.

A short metal prod extending from the side of the instrument is held against the equipment. Vibrations are transmitted by the prod through a system of levers to the stylus. Magnified approximately 12 times, the vibrations are traced on a moving tape showing the wave form. A synchronous motor drives the tape at speeds of one or three inches per second. By providing two speeds the instrument is better adapted to measuring vibrations over a wide frequency range. Another stylus makes a small timing mark on the edge of the tape every one third of a second.

From this graph of vibration displacement against time, both steady-state and transient vibrations may be analyzed. When analyzing shock waves such as produced by a punch press, the large initial displacement is due to shock, while the succeeding waves are caused by steady-state vibrations.

Many applications have been found for this instrument in checking rotating equipment such as compressors, motors, blowers, fans, and pumps to ascertain the source of vibrations. Recently a vibration analysis was made of the panel instruments of a B-29 during flight. Engineers sought to determine the amount of vibration these panel instruments could withstand without a decrease in accuracy. Additional information was gathered on the construction, insulation, and mounting of the panel instruments.

Bolts securing the armature laminations were found to be the source of excessive vibration in a main propulsion motor of the Army transport ship *General Sultan*. Without dismantling the armature the recording vibrometer indicated that the resonant frequency of the bolts was identical to the normal magnetic frequency of the motor.

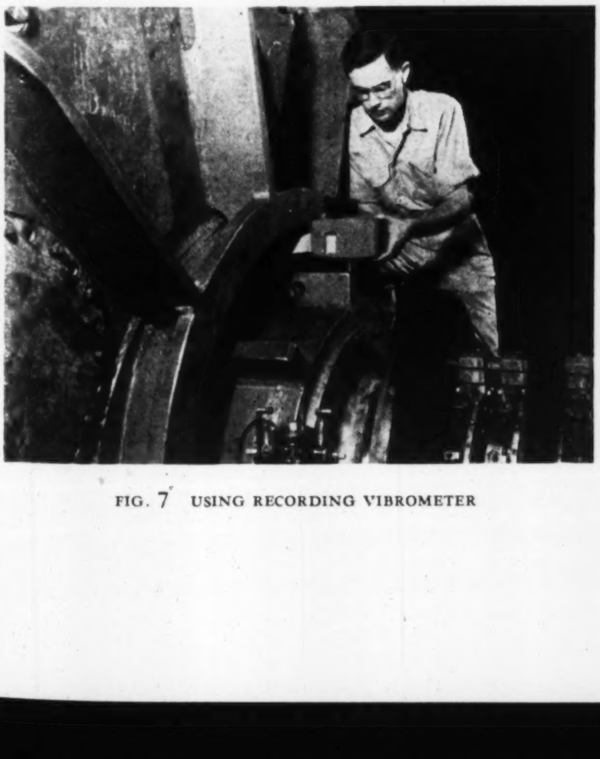


FIG. 7 USING RECORDING VIBROMETER

Gas Turbines

AN early end for the use of the high-powered aviation piston engine by itself, both for military and commercial applications, was forecast recently by Dr. John T. Rettaliata, Mem. ASME, dean of engineering, Illinois Institute of Technology, Chicago, Ill., in an address before the Illinois Tech Mechanics Colloquium. He predicted that the gas turbine will be well entrenched within five years in the high-speed large-commercial-transport field, and within ten years its supplanting of piston engines for this use should be essentially complete.

While its use will be restricted, the propeller will not disappear with the piston engine, according to Dr. Rettaliata. He said that gas turbines driving propellers through reduction gears are the best type of aircraft power for moderate subsonic speeds. As flight speed is reduced, the propulsion efficiency of jet engines is decreased; whereas propeller efficiency is maximum at moderate speed and falls off at high speeds, he explained. For speeds up to 550 mph, propellers in their present state will probably have predominant application. Even with further development, however, they will not be used on supersonic planes.

In the advanced supersonic speed ranges, the following three types of power plants for propulsion of aircraft are applicable: (1) Turboramjet engines, where additional fuel is burned in the tail pipe of a turbojet to increase the velocity of exhaust gas and hence increase thrust. (2) Ramjet engines, composed of a simple duct, the forward end of which consists of a diffuser to slow down the high velocity of incoming air and increase its pressure, with the air next passing through a heating chamber, and finally expanding through a rear-duct nozzle and being emitted at high velocity to produce a thrust. (3) Rocket engines, carrying their own self-contained fuel and oxygen and therefore independent of the earth's atmosphere.

According to Dr. Rettaliata an airplane with a ramjet engine would have the longest range at supersonic speeds with conventional fuels, but it would have to be launched by some other means since the ramjet is not self-starting.

The next longest range could be obtained with a turboramjet engine, which has an additional advantage of producing a static thrust for take-off. The rocket engine will have the shortest range, but will give the greatest thrust per unit weight. This latter feature, he explained, is the reason the highest supersonic speeds have been made with an airplane employing rocket propulsion.

He stated that with atomic fuels, almost unlimited range appears attainable. Furthermore, for a rocket power plant, nuclear energy would provide the greatest thrust per pound of fuel used per second. He cautioned, however, that some time may elapse before a successful atomic-powered plane is achieved, as problems of high temperature, heat transfer, and shielding of personnel from gamma rays and neutrons emitted during the fission process would have to be solved first.

Turning to the personal-plane field, Dr. Rettaliata explained that the low-power piston engine with propeller can expect a long life. A compound engine, consisting of a piston engine whose exhaust gas is supplied to a gas turbine and the power from both furnished to a propeller, has some attractive possibilities for the future. He pointed out that a power plant of this type will give the longest range at low flight speeds.

It is believed, however, that the application of such types of engines is limited, and the prophecy of the ultimate superseding of piston engines by gas turbines for high-speed flight is valid.

ASME TECHNICAL DIGEST

Substance in Brief of Papers Presented at ASME Meetings

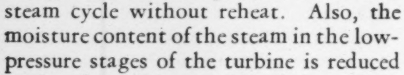
Reheat Turbines

High-Pressure Boilers With Reheaters, by W. H. Rowand, A. E. Raynor, and F. X. Gilg, Members ASME, The Babcock & Wilcox Company, New York, N. Y. 1948 ASME Annual Meeting paper No. **48—A-60** (mimeographed).

The purpose of this paper is to describe the application of reheaters to modern high-pressure boilers.

In the reheat steam cycle, partly expanded steam is withdrawn from the turbine and led to a reheater in which the steam is reheated, i.e., its temperature and heat content are increased. From the reheater, the steam is led back to the turbine or another turbine to complete its expansion. As can be seen from a temperature-entropy chart, a greater portion of the heat added to the steam in the reheat cycle is converted to useful energy than would be possible in a normal steam cycle without reheat. Also, the moisture content of the steam in the low-pressure stages of the turbine is reduced so that destructive erosion of the turbine blades is minimized.

When a high-efficiency steam-generating unit is available as part of the equipment in a reheat steam cycle, the net heat rate in Btu's required to produce a kilowatt of electric energy is reduced. A major factor in operating cost is reduced.


SUPERHEATER INLET
SUPERHEATER ATTEMPERATORS
REHEAT SUPERHEATER OUTLET
REHEATER ATTEMPERATORS
SUPERHEATER OUTLET
REHEATER ATTEMP INLET CONNECTION

HIGH-PRESSURE BOILER WITH REHEATER (930,000 lb per hr, 2080-psi, 1050-F, 1000-F reheat, Philip Sporn Plant.)

With the development of alloy materials suitable for higher temperatures, it became more profitable to invest in the nonreheat system with higher primary steam temperatures, and to give up the relatively less productive savings from reheat. Now we are again reaching a temporary limitation in steam temperatures, and with the rapidly increasing cost of fuels, the reheat cycle is again becoming popular, but at a much higher level of temperature and pressure than those that made it attractive in the mid-twenties. Reheater units are being built today for primary steam temperature of 1050 F, reheat steam temperature of 1000 F, and initial pressures up to 2500 psi.

The use of higher steam pressures and temperatures has resulted in a steady reduction of station heat rates on new generating equipment. There doesn't seem to be much probability of using pressures higher than 2500 psi. The possibility of future improvement lies more in the direction of higher temperatures, but, for the time being, 1100 F is about the top commercial limit to high temperatures at high pressures. Therefore utility engineers, in pursuit of lower costs in generating power, are again considering the reheat cycle at temperatures of 1000 F and even 1050 F and are finding that in some cases, it is economically justified in the light of present-day fuel costs.

Reheaters are actually superheaters and are generally installed as convection surface in a boiler setting. In the mid-twenties, a few live-steam reheaters were used. Reheaters are subject to the same design factors as superheaters, requiring the correct amount of surface, arranged with the proper internal and external flow areas to insure satisfactory tube-metal temperatures and a uniform distribution of steam and gas flow over the reheating surfaces.

Operating Experiences in Connection With Regenerative Reheat Turbine Installations, by C. A. Robertson, Mem. ASME, Allis-Chalmers Manufacturing Company, Milwaukee, Wis. 1948 ASME Annual Meeting paper No. **48—A-91** (mimeographed).

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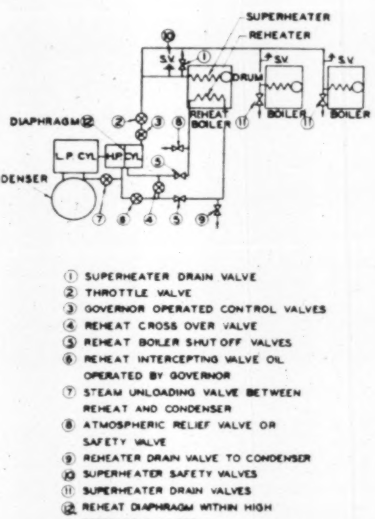
Renewed interest in the reheat cycle for large steam turbines can be based not only on the inherent increase in thermal economy obtainable but also on the equivalent flexible performance between reheat and nonreheat units as indicated by the 18 years' operating experience of one large turbine manufacturer. Operating records of these regenerative reheat steam turbines have included base-load and varying-load operation, together with frequent start-up and shutdown performance. Protective equipment in the reheat line has functioned reliably and the modifications that have been made relate more or less to details of design.

The earlier regenerative reheat units have been in operation for some 18 years. These are supplied by steam generated from a bank of boilers and a separate reheat boiler. Protective equipment in


SUPERHEATER
REHEATER
⑩
SV
①
DRUM
SV
SV
DIAPHRAGM ⑫
②
③
⑧
REHEAT BOILER
⑪
BOILER
⑪
BOILER
L.P. CYL.
H.P. CYL.
⑤
CONDENSER
⑦
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⑤
⑨
① SUPERHEATER DRAIN VALVE
② THROTTLE VALVE
③ GOVERNOR OPERATED CONTROL VALVES
④ REHEAT CROSS OVER VALVE
⑤ REHEAT BOILER SHUT OFF VALVES
⑥ REHEAT INTERCEPTING VALVE OIL OPERATED BY GOVERNOR
⑦ STEAM UNLOADING VALVE BETWEEN REHEAT AND CONDENSER
⑧ ATMOSPHERIC RELIEF VALVE OR SAFETY VALVE
⑨ REHEATER DRAIN VALVE TO CONDENSER
⑩ SUPERHEATER SAFETY VALVES
⑪ SUPERHEATER DRAIN VALVES
⑫ REHEAT DIAPHRAGM WITHIN HIGH PRESSURE CYLINDER

SCHEMATIC ARRANGEMENT OF REHEAT CYCLE INCLUDING BOILERS AND TURBINES

the reheat lines consists of intercepting and steam unloading valves. These units have performed comparably with nonreheat units located in the same station.

An 80,000-kw unit of later design in another station, supplied from a single boiler with a resuperheating section, has set the highest standard of performance in the industry. Subsequent 80,000-kw reheat units in this station are in operation, being installed, or under construction.

Initial objections to the wide use of the reheat cycle for large turbines were based on a reluctance to increase the unit investment for reheat unless it enabled a reduction of exhaust moisture to below 12 per cent. At some higher steam pressures, reheat was the best answer to high exhaust blade erosion by moisture.

Today the reheat cycle enables an inherent gain in the thermal economy of large turbines which is variously estimated at from 4 to 6 per cent.

This paper factually discusses the important features of the operation of reheat turbines and should further reduce any remaining objections to application of the cycle.

Modern Reheat Boilers, by W. S. Patterson, Mem. ASME, Combustion Engineering Company, Inc., New York, N. Y. 1948 ASME Annual Meeting paper No. **48—A-106** (mimeographed).

This paper gives a brief historical résumé of reheat progress followed by a discussion of the design factors which dictate the size, shape, and proportions of a large reheat steam generator. A few typical installations are illustrated and discussed and general comments on operational procedures are included.

In the earliest applications of the reheat cycle in power stations, dating back more than 20 years, reheating of the steam was done in separate reheaters.

A few years later, units were built with the reheater located within the confines of the steam generator and some of these installations employed radiant reheat surface.

Some reheat installations have been used in connection with "topping" turbines in which the primary steam is expanded through a new high-pressure turbine and then reheated at the original pressure of the station for use in the older turbines.

The high cost of fuel, material, and labor since World War II has increased the popularity of reheat boilers in central stations because of better station economy and many such units are now in process of design or construction, selected for primary steam pressure of 1400–2200 psi, primary-steam temperature up to 1050 F, and reheated-steam temperature up to 1000 F. The high cost of material and labor also makes it desirable to build these units in large sizes, connected to a single turbine and without cross-connection between the boilers. Single boiler reheat installation is being considered up to a capacity of 1.5 billion Btu per hour fuel-firing rate.

When all superheating and reheating can be accomplished with convection surfaces these modern reheat units are not much different in appearance from large nonreheat units, since the reheater is simply placed between the primary and secondary superheater. The secret of this simplicity lies in the ability to design a unit with controlled gas temperature leaving the furnace through the use of tilting burners.

Steam-Generating Equipment for Resuperheating Cycles, by Martin Frisch, Mem. ASME, Foster-Wheeler Corporation, New York, N. Y. 1948 ASME Annual Meeting paper No. **48—A-120** (mimeographed).

Several new central-station units employing high-temperature resuperheating cycles will soon be operating. These units, designed to conserve fuel, were planned by farsighted utilities operators to offset rising fuel costs.

For many years one prominent utility in the Middle West has operated several units with turbine conditions as follows: Primary throttle steam at 1300 psig and 830 F; resuperheated steam at 375 psig and 835 F.

The two resuperheating cycles recently given most serious consideration involve turbine conditions as follows: (1) Primary steam to high-pressure turbine at 1450 psig and 1000 F. Resuperheated steam to low-pressure turbine at 400 psig and 1000 F. (2) Primary steam to high-pressure turbine at 2000 psig and 1050 F. Resuperheated steam to low-pressure turbine at 400 psig and 1000 F.

The design of steam generators for these conditions poses certain problems which do not have to be considered when resuperheaters are not included. This paper reviews these problems and determines how their necessary solutions affect the design and the cost of steam generators per kilowatt of turbine-generator capability for resuperheating units as compared with nonresuperheating units. Two types of units are considered: (1) Units utilizing convection surface only for superheating and resuperheating; and (2) units utilizing radiant superheaters in combination with convection surface.

The effects on equipment costs of furnace exit-temperature limitations imposed by fuel quality and load range over which primary and resuperheated steam temperatures must remain constant, are examined in detail. Data are presented comparing present-day prices of steam-generating equipment per kilowatt of turbine-generator capacity for several high-temperature and high-pressure resuperheating and nonresuperheating cycles usually employed in power stations.

Gas-Turbine Power

Current Design Practices for Gas-Turbine Power Elements, by H. D. Emmert, Mem. ASME, Allis-Chalmers Manufacturing Company, Milwaukee, Wis. 1948 ASME Annual Meeting paper No. **48—A-69** (mimeographed).

Numerous technical discussions have been published during the past several years concerning the general features and potentialities of gas-turbine plants for land, marine, and air service. This paper is restricted to the consideration of a single component of the gas-turbine plant—the basic power turbine—and reviews certain principles and procedures for analysis which are based on the experience of the gas-turbine engineering group of the Allis-Chalmers Manufacturing Company.

The techniques employed in the design of gas-turbine power elements depend to a large extent upon the type of service for which the machines are intended. The turbines under consideration in this paper are classified as "commercial"

BLADED DISK, INLET SIDE, BLADES ATTACHED BY WELDING

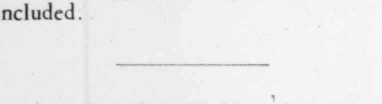
units. This classification is arbitrarily defined to include only those machines designed for comparatively long-life service as (*a*) power generators and process units in utility and industrial plants, or (*b*) prime movers for locomotive and marine propulsion.

A limitation is observed with reference to the phases of the over-all turbine-design problem to be discussed. The phases under consideration include: (*a*) The design of the turbine blade path from the standpoint of fluid mechanics; and (*b*) the basic principles of stress analysis used for the blades and blade-carrying elements. The mechanical construction of such parts as casings, bearings, supports, and governors is not included.

A 5000-Kw Gas Turbine for Power Generation, by Alan Howard and Chapman J. Walker, Members ASME, General Electric Company, Schenectady, N. Y. 1948 ASME Annual Meeting paper No. **48—A-83** (mimeographed).

A 5000-kw gas turbine for power generation has been designed and is in manufacture. The paper describes the design features and gives the anticipated performance characteristics.

A 3500-kw stationary power plant is being extended to include a 5000-kw stationary power plant, designed for continuous central-station-type service, with relatively high thermal efficiency. The unit is in manufacture, and factory tests are expected to start early in 1949. This gas turbine is designed for continuous operation at 1500 F turbine-inlet temperature, and is expected to produce a kilowatthour at the generator terminals for 12,900 Btu at rated conditions, based on the higher heating value (18,400 Btu per lb) of bunker "C" fuel oil (LHV = 17,400 Btu per lb). With minor changes, it should be able to burn practically any liquid or gaseous hydrocarbon fuel. The construction is such that no major design should be required to permit the use of coal as a fuel, when coal combustion for gas turbines has been sufficiently developed.



CYCLE DIAGRAM WITH PERTINENT PRESSURES, TEMPERATURES, FLOWS, AND OUTPUT FOR DESIGN RATING AT 1500 FT ALTITUDE

Although this unit is designed for continuous service, its anticipated quick-starting characteristics and relatively good light-load performance should make it attractive as a stand-by, peak-load, or end-of-line unit. The power plant, including prime mover, generator, starting means, fuel and lubricating systems, and control is a completely co-ordinated design supplied as a package unit. Since the control is a single co-ordinated governing system, a minimum of supervision is required, and it is expected that this power plant can be made fully automatic with remote supervision and control.

Test of a 4800-Hp Gas-Turbine Power Plant, by Alan Howard and B. O. Buckland, Members ASME, General Electric Company, Schenectady, N. Y. 1948 ASME Annual Meeting paper No. **48—A-98** (mimeographed).

Extensive tests have been run on a 4800-hp gas-turbine power plant designed for locomotive and other applications. A total of approximately 700 hr of operating time was accumulated during the test period. After the first 100 hr, during which all operation was on Diesel fuel, about 80 per cent of the operative time has been on grade 6 fuel oil, and the remaining 20 per cent on Diesel fuel oil. The results of this experience are considered definitely encouraging, although some troubles were encountered. The indications are that no major design changes will be required.

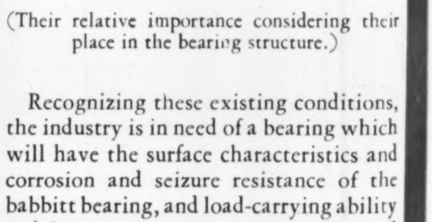
The design rating of this plant is 4800 shp, referred to 80 F ambient temperature and to 1500 ft altitude, or approximately 5000 hp at sea level. The unit delivers its rated power with an estimated turbine-inlet temperature of about 1300 F compared to the design temperature of 1400 F. At the rated power condition, the thermal efficiency is slightly over 17 per cent, based on the lower heating value of the fuel. The anticipated thermal efficiency based on shaft output and the lower heating value of the fuel was between 17 and 18 per cent. When operated with an inlet temperature of 1400 F, the output of the unit is approximately 6000 hp or 120 per cent of rating, and the thermal efficiency, based on lower heating value, is approximately 18.5 per cent. For the present the rating of the unit is being maintained at the original design value. Under cold weather conditions the unit has been run at an actual output of 6400 hp.

In general, the mechanical operation has been good with very little vibration or expansion trouble being encountered. The combustion efficiency is high, 96 per cent and above, and after a few initial difficulties there has been almost no trouble with carbon or similar combustion troubles. The control system is such that the starting and operation of the unit is almost fully automatic. Over half the running time has been on load cycles simulating heavy-load railway service.

Machine Design

Plain Bearings—Today and Tomorrow, by E. Crankshaw, Mem. ASME, Cleveland Graphite Bronze Co., Cleveland, Ohio. 1948 ASME Annual Meeting paper No. **48—A-63** (mimeographed).

Present-day bearing materials have given a good account of themselves in their various proper applications. However, bearing failures are experienced and these are chiefly attributable to three factors: (1) Substantial increases in rated engine output without fundamental design changes; (2) improper installation; and (3) sustained demands of the engine beyond its designed intentions.



.020 NOMINAL THICKNESS BEARING SURFACE LAYER

DECREASING VALUE

BEARING QUALITY	FATIGUE RESISTANCE	CORROSION RESISTANCE
LEAD BASE	SILVER	SILVER
TIN BASE	CLEVITE 77	TIN BASE
LEAD TIN PLATE	LEADED BRONZE	LEAD BASE
CADMIUM	CLEVITE 35	LEAD TIN PLATE
CLEVITE 35	CADMIUM	CLEVITE 77
CLEVITE 77	LEAD BASE	LEADED BRONZE
SILVER	TIN BASE	CLEVITE 35
LEADED BRONZE	LEAD TIN PLATE	

CHARACTERISTICS OF VARIOUS BEARING MATERIALS

(Their relative importance considering their place in the bearing structure.)

Recognizing these existing conditions, the industry is in need of a bearing which will have the surface characteristics and corrosion and seizure resistance of the babbitt bearing, and load-carrying ability and fatigue resistance of the steel-backed copper-lead bearing. The present-day trimetal bearings, steel-backed construction, copper-lead intermediate layer and babbitt bearing surface, are fulfilling today's requirements. Research and development is in process to improve this bearing and develop a new bearing which will meet tomorrow's demands.

With the present-day engines, which are operating under higher loads and speeds than ever before, it has become increasingly important that the bearings are installed under proper conditions. To do this a vast educational program will have to be instituted throughout the entire industry, initiating with the manufacturer and being carried down through the service departments and corner garages. Proper instruction manuals and verbal instructions on running clearances, bearing-bore eccentricity, taper, hourglass, fillet ride, parallelism and twist, finish, and shaft and case alignment must be distributed so that both new and rebuilt engines will show good bearing life.

To do this it will be necessary to be able to recognize and diagnose typical bearing failures such as fatigue, wiping, dirt, and uneven wear and fatigue due to improper installation.

Much of this paper is based on information on engine design because of the availability of extensive data from engine operation as well as laboratory tests; nevertheless, many of the principles can be applied to the various bearing applications.

Roller-Chain Designs and Their Engineering Applications, by Joseph Joy, Mem. ASME, General Chain and Belt Company, New York, N. Y. 1948 ASME Annual Meeting paper No. **48—A-66** (mimeographed).

The roller chain is actually an assembly of two component subassemblies, namely, "roller link" and "pin link." A roller link is an assembly of two inner-link plates, two bushings, and two rollers. A pin link is an assembly of two outer-link plates and two pins.

Small sizes of roller chain are well known as the means of transmitting power to the rear wheel of the bicycle and the motorcycle. Larger sizes in the single and multiple widths are used for the transmission of power in a wide variety of usages.

Sprocket-tooth engaging dimensions of the roller chain (pitch and roller diameter), also other essential dimensions, and sprocket-tooth shape have been standardized to the extent that not only will any make of chain conforming to the American Standard mesh interchangeably on sprockets with American Standard tooth form, but complete roller links and pin links of the various makes will also interchange.

Some nonstandard sizes of roller chain are produced in considerable volume. There are two classes of such chains: One class has dimensions that were in use prior to the adoption of the present standards nearly a quarter of a century ago. These chains, supplied principally for replacement services, generally do not have interchangeability of parts among the various makes, and ordinarily have smaller roller diameters than American Standard chains of the same pitch. Tensile strengths are generally lower and primary adaptations usually are not available. The other class of chains conforms to American Standards in all respects except that roller widths are narrower than standard.

Another series of roller chains, known as the conveyer or extended-pitch series was created to extend the field of usage. These chains have the same pin and bushing as the American Standard series but the link-plate pitch is twice as long as that of the comparable standard series. These chains are available with rollers of the standard diameter, and with "oversize" rollers which project beyond the link plates. Link plates may be of the "hourglass" contour or they may have straight edges, inner and outer link in the latter case generally being of identical contour.

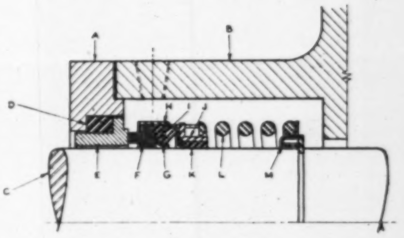
The sizes of American Standard roller chains range from $^{1}/_{4}$-in. pitch, 875 lb tensile strength, single strand, to $2^{1}/_{2}$-in. pitch, 95,000 lb tensile strength, single strand, and 570,000 lb tensile strength sextuple strand. Drives involving shaft speeds in the vicinity of 8000 rpm are entirely practical, and at the other extreme, with paired multiple strand $2^{1}/_{2}$-in. pitch chains, as much as 3000 hp can be handled in the moderate-speed ranges.

Chain selection, special chain adaptations, examples of use, and thermal considerations are covered.

The Mechanical Seal—Its Construction, Application, and Utility, by Carl E. Schmitz, Mem. ASME, Crane Packing Company, Chicago, Ill. 1948 ASME Annual Meeting paper No. **48—A-70** (mimeographed).

This paper outlines important construction features of the mechanical seal; discusses speed, pressure, temperature, and viscosity; application considerations, advantages, and when special construction is desirable; utility of the mechanical seal; and suggested services.

All mechanical seals are basically composed of a rotating and stationary element, and some means of keeping them in contact.



TYPICAL MECHANICAL SEAL APPLIED TO A CONVENTIONAL STUFFING BOX OR OTHER MECHANICAL DEVICE

[(A) Gland plate or cover; (B) stuffing box; (C) shaft; (D) floating seat ring; (E) floating seat; (F) sealing washer; (G) shaft protecting ferrule; (H) retainer shell; (I) bellows flange retainer; (J) driving band; (K) synthetic-rubber bellows; (L) spring; (M) spring retainer.]

Construction is important and every interested prospective user should fully acquaint himself with the desirable factors and necessary requirements for his particular job and insist that the seal used possess all of the desirable factors that go to make up a good seal.

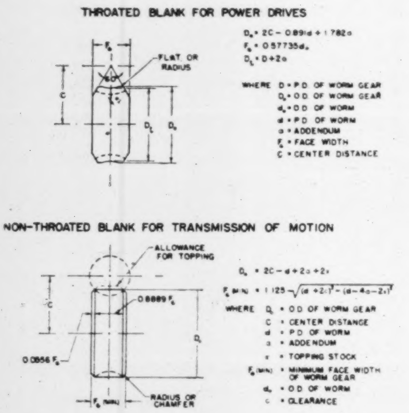
Application of the proper seal to the job is the answer to successful performance. Submit your application problems to a qualified manufacturer before you are too far advanced with construction details. Follow closely layout submitted and approved for the particular job under consideration and thus assure a successful seal application.

Utility is unlimited and the prospective seal user would do well to deal only with a manufacturer competent and capable of analyzing the specific problem, and willing to work with the equipment manufacturer toward a successful fruition of the problem involved.

A Simplified Fine-Pitch Worm-Gearing Standard, by Louis D. Martin, Eastman Kodak Company, Rochester, N. Y. 1948 ASME Annual Meeting paper No. **48—A-82** (mimeographed).

The Fine-Pitch Gearing Committee of the American Gear Manufacturers Association and The American Society of Mechanical Engineers' Subcommittee B.6 on Fine-Pitch Gears, are cosponsors of a simplified fine-pitch worm-gear standard entitled AGMA Standard Practice Design and Rating for Fine Pitch Worm Gearing, No. 374.01. Part one of this standard covering the design aspects is discussed in this paper. Part two which will cover such items as load-carrying capacity, materials, coefficient of friction, and lubricants suitable for fine-pitch worm gearing is in the process of development.

This standard covers only worms and worm gears with axes at right angles,



RECOMMENDED WORM-GEAR BLANK DESIGN

comprising cylindrical worms with helical threads, the worm gear being hobbed for fully conjugate tooth surfaces. This standard is limited to the case where the hob for producing the gear is a counterpart of the mating worm in regard to its tooth profile, number of threads, and lead. The hob thread dimension differs from the worm principally in the higher addendum for sharpening allowance which makes its outside diameter larger than the worm.

Only eight axial pitches are used, which are: 0.030 in., 0.040 in., 0.050 in., 0.065 in., 0.080 in., 0.100 in., 0.130 in., 0.160 in.

This pitch range was established because it has the following advantages: (1) Adequate coverage; (2) all pitches are divisible by ten or five; (3) rational increase from one pitch to another based on geometric series rounded out for practical reasons; (4) ease of remembering.

Axial pitch was selected as a basis for this standard for the following reasons: (1) Axial pitch establishes lead which is a basic dimension in producing and inspecting worms; (2) axial pitch of the worm is equal to the circular pitch of the worm gear in the central plane; (3) on commonly available worm-producing equipment only one set of change gears or one master lead cam is required for a given lead, regardless of lead angle; (4) it conforms with well-established practices in determining load ratings.

Fifteen lead angles cover the entire range of fine-pitch worms. Standard lead angles are: 0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 7.0, 9.0, 11.0, 14.0, 17.0, 21.0, 25.0, and 30.0 deg.

This series of lead angles was established because: (1) It gives adequate coverage; (2) it takes into account the production distribution found in the fine-pitch worm-gearing field.

A number of examples are given explaining the use of this standard.

It is expected that this standard will be released for publication in the near future. Its critics have expressed the opinion that it sets a new pattern on simplification of a complex subject. It is the hope of its sponsors that it will be accepted with favor by the fine-pitch gearing industry and prove useful to our armed forces.

Tests on V-Belt Drives and Flat-Belt Crowning, by C. A. Norman, Mem. ASME, The Ohio State University, Columbus, Ohio. 1948 ASME Annual Meeting paper No. **48—A-102** (mimeographed).

This investigation was conducted to clear up under just what tension the front-end belt drives on certain important automotive vehicles ought to be applied to insure dependable power transmission even under sustained heavy load and yet insure a reasonable belt life. These drives involve high speeds, small contact angles, and also small pulley diameters. It was therefore necessary to clear up the influence of contact angle on transmissive power with the small pulley diameters used. Also belt-life determinations were in order.

The project involved, in fact, all the fundamentals of power transmission with modern V-belts.

It was found that centrifugal force may have much less influence than commonly assumed. This is true particularly for belts with small elastic stretch, such as belts with steel-wire transmitting organs; but is fairly true also for other modern V-belts, except that belts with textile transmitting organs may slip somewhat more than steel-wire belts.

A drive with fixed shaft distance, as long as the belt has not undergone much permanent stretch, can transmit more torque than a floating drive with total tension set by a tensioning device.

On comparatively small pulleys, the actual arc of contact between a V-belt, or other stiff belts, and the pulley may be much smaller than the conventional one obtained by representing the belt by straight lines drawn tangent to the pulley circumference. The actual effect of conventional contact angle can therefore be obtained only by direct test.

From the point of view simply of the torque transmitted, the tests seem to indicate that for V-belts the ratio of pulley diameter to belt thickness should not be less than 12 (ratio of belt thickness to pulley diameter should not be more than 0.08). For so-called Wedge belts the diameter/belt-thickness ratio may be 10 (the inverse ratio 0.1). These values correspond also to the minimum diameters usually prescribed from the point of view of reasonable belt life.

The ratio of total tension with power transmission to initially applied total tension without power transmission depends among other things on the stress-strain curve of the belt. From this point of view the running total tension may be either smaller than, or larger than, or equal to the initial tension. If the slack-side tension drops to zero, so that the belt can no longer contract on the slack side, and if power is still transmitted, the total tension becomes simply equal to the tight-side tension.

Modern flat belts, particularly with steel-wire transmitting organs, do not conform to a crown as well as old-time leather belts. It is bad for the belt to be riding merely on a ridge and to transmit the full tension only in the middle. Hence the need for finding the minimum crowns needed to keep the belts guided.

It was found that a crown of 0.10 in. on the diameter per foot of pulley width was necessary to guide all belts without special adjustment of shaft alignment.

A crown of 0.06 in. will be satisfactory for modern belts if the shafts are specially aligned for the belts used. Narrow belts respond to increased crown more readily than wide belts. Slack belts are more easily guided than belts under heavy tension.

Fuels

Catalytic-Cracking Plants for Relieving Gas-Utility Peak Loads, by C. G. Milbourne, Surface Combustion Corporation, Toledo, Ohio. 1948 ASME Annual Meeting paper No. **48—A-101** (mimeographed).

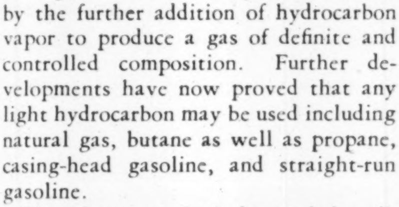
Offering a new approach to the peak-load problem of the gas utility, the first catalytic-cracking plant ever to attain full commercial operation for a gas utility began delivering gas to the distribution mains of the Long Island Lighting Company in January, 1948.

The installation comprises three catalytic-cracking furnaces, each of 8-tube size. The furnaces are rectangular and are mounted vertically. Each furnace is approximately 11 ft square and 24 ft high, with the base 9 ft above ground level. The furnaces are of steel and are refractory-lined. The eight cracking tubes are suspended at the top of each furnace. Each tube is 5.75 in. ID, 26 ft long, and is of a special chromium-nickel alloy. A flexible connection through which the gas-air stream mixture is fed, is attached at the bottom.

Each furnace is heated by 15 oil burners installed in three rows of five in the furnace floor. The burners are located so that each tube is heated by four burners, thereby providing uniform heating. Approximately 19 ft of the furnace height in the hot zone is filled with small pieces of rock. The catalyst is a special nickel oxide impregnated in a support consisting of $^3/_4$-in. refractory tubes. The tubes are connected to manifolds at top and bottom and are provided with valves to permit any tube to be isolated from others should a tube fail or require burning out of carbon deposits. Air-supply lines at the bottom and vent lines at the top permit revival of the catalyst in any tube without affecting the operation of the others. Peepholes are provided in the furnace setting for visual observation of the tubes for possible leakage.

This particular catalytic-cracking furnace breaks down propane or butane vapor into a fixed gas consisting mainly of hydrogen and carbon monoxide. This gas is automatically cold-enriched by the further addition of hydrocarbon vapor to produce a gas of definite and controlled composition. Further developments have now proved that any light hydrocarbon may be used including natural gas, butane as well as propane, casing-head gasoline, and straight-run gasoline.

The plants are entirely smokeless in operation, require no gas holders, are unusually compact, and are relatively low in initial and operative costs. They manufacture a gas requiring no purification. No by-products such as tar, nor other odorous hard-to-dispose-of effluents are produced thereby permitting the installation of the units adjoining suburban areas where peak-load demands may be highest. Gas of any heating value ranging from 180 Btu to approximately 1000 Btu can be produced.



SECTION OF CRACKING FURNACE SHOWING TUBES, FEED CONNECTIONS AT BOTTOM, INSULATED CASING, AND OUTLET MANIFOLDING

Applied Mechanics

Energy Method for Determining Dynamic Characteristics of Mechanisms, by B. E. Quinn, Mem. ASME, Purdue University, Lafayette, Ind. 1948 ASME Annual Meeting paper No. **48—A-18** (in type; to be published in the *Journal of Applied Mechanics*).

Two types of problems are dealt with in this paper which are involved in the design of mechanisms required to have specified dynamic characteristics: (1) Determination of applied forces required to produce specified dynamic characteristics. (2) Determination of the dynamic characteristics which will result from the application of known forces. While graphical methods may be used in the solution of type-1 problems involving more or less complex mechanical systems, they do not afford a direct approach to type-2 problems. The energy method which will be outlined can be applied in either case, although this paper will be primarily concerned with the determination of the dynamic characteristics which result when a known force is applied to a given mechanism.

Supersonic Flow Past Airfoil Tips, by Leon Beskin, (deceased) was Mem. ASME, and with Navy Department, Washington, D. C. 1948 ASME Annual Meeting paper No. **48—A-23** (in type; to be published in the *Journal of Applied Mechanics*).

Airfoils examined in this paper are constituted by developable surfaces with arbitrary cross sections, all the generators of the surfaces, including the sharp leading and trailing edges, being supersonic. The tips are constituted by supersonic sections, which are generally blunt. The flow past an airfoil is determined by application of linearized equations, by means of Busemann's conical flow theory. The two fundamental cases are that of a plate at a small angle of attack, and that of a slender wedge at zero angle of attack. In both cases, the supersonic leading edge and the subsonic tip may have arbitrary directions. The tip, particularly, may be either parallel to the flow, or acting as a leading edge, or else acting as a trailing edge, and each condition must be considered separately. All other conditions are solved by superposition of the two fundamental cases, antisymmetrical conditions resulting from the first case, and symmetrical conditions from the second. Thus the general solution for the flow about a developable surface with arbitrary thickness and camber distributions, limited to a plane subsonic tip, is simply obtained under the conventional restrictions of the linear theory. While the absolutely general case of a developable surface, constituted by the tangents to an arbitrary edge of retrogradation, appears to be of limited interest, major applications correspond to special cases of developable surfaces; cylindrical, prismatical, conical, and pyramidal airfoils.

Thermal Stresses in a Rectangular Plate Clamped Along an Edge, by B. J. Aleck, Jun. ASME, The M. W. Kellogg Company, Jersey City, N. J. 1948 ASME Annual Meeting paper No. **48—A-28** (in type; to be published in the *Journal of Applied Mechanics*).

An approximate solution has been obtained for the stresses induced by a uniform change in temperature of a thin rectangular plate, clamped along an edge. The solution has been carried to completion for plates whose clamped edge is long, i.e., more than 5 times the length of the perpendicular free edge. The solution for smaller ratios of clamped to perpendicular lengths is expressed in terms of six determined functions whose coefficients are to be evaluated by satisfying two boundary conditions. The thermal-stress problem is first converted to one of specified boundary tractions. The normal stress σ_x parallel to the clamped edge is assumed of the form $\sigma_x = f_1(x) + yf_2(x) + y^2f_3(x)$, where $f_1(x)$ are as yet undetermined functions, and where o is the co-ordinate at right angles to the clamped edge. Using the equations of equilibrium and the boundary conditions, τ_{xy} and σ_y are expressed in terms of powers of y and the derivatives of $f_1(x)$. The integral representing the strain energy is then expressed in terms of the expression for σ_x, σ_y, and τ_{xy}. In accordance with the principle of least work, the integral representing the strain-energy is minimized, using the calculus of variations. The resulting simultaneous differential equations for $f_1(x)$ are solved as a linear combination of twelve functions (six of which drop out, by symmetry). Given $f_1(x)$, then $f_2(x)$ and $f_3(x)$ are determinate by virtue of the simultaneous equations. The six coefficients in the expression for f_1 are evaluated by satisfying the boundary conditions along the free edges. The maximum normal stress concentration, over 10, occurs at the junction of the free and clamped edges.

Stress Concentration Around a Triaxial Ellipsoidal Cavity, by M. A. Sadowsky Mem. ASME, and E. S. Sternberg, Illinois Institute of Technology, Chicago, Ill. 1948 ASME Annual Meeting paper No. **48—A-29** (in type; to be published in the *Journal of Applied Mechanics*).

Previous investigations have been concerned with the stress concentrations around internal cavities in the shape of an ellipsoid of revolution. This paper contains an exact closed solution, in terms of Jacobian elliptic functions, for the stress distribution around a general triaxial ellipsoidal cavity in an infinite elastic body. The body at infinity is in a uniform state of stress whose principal directions are parallel to the axes of the cavity, the magnitudes of the principal stresses at infinity being arbitrary. The solution covers as limiting cases the known results for spherical and spheroidal cavities. The technically important aspects of the ensuing stress concentration are discussed in detail.

The Forces and Moments in the Leg During Level Walking, by B. Bresler and J. P. Frankel, University of California, Los Angeles, Calif. 1948 ASME Annual Meeting paper No. **48—A-62** (mimeographed).

As a locomotive mechanism the human body is extremely complex. In order to perform the various operations of locomotion such as walking, running, climbing slopes and stairs, man has been provided with an articulating system of levers (the arms, torso, and legs) connected by "superuniversal" joints (the shoulder, hip, knee, and ankle joints, for example). These levers are powered with a multitude of motor units (the muscle fibers) and operated by an elaborate network of controls (the nervous system).

The human mechanism is one that operates in three dimensions—further complicating its analysis. It is true that the main effects of locomotion are evidenced in a single plane (the plane of progression) but this should not lead one to neglect the effect of lateral displacement on the mechanics of locomotion. This omission has been made by some previous investigators in order to simplify the mechanical aspects of the problem—but does not seem to be justified by the results of this investigation.

Unlike the inanimate machines, one human body varies greatly from another in build (mass distribution), musculature (power supply), and mannerisms of motion (controlled by the nervous system). The effect of these variables on the displacement and forces involved in the locomotion process introduces an additional complication into the analysis of the experimental data.

Before attempting to correct any mechanical deficiencies in the human body, the surgeon, limb and brace maker, and physiotherapist must be well-acquainted with the mechanical functions of the affected parts of the body. The techniques and scope of orthopedic treatment and surgery, limb and brace fitting, and the like, are seriously limited by the force and displacement characteristics normally involved in the damaged or missing members. Recognizing the need for a scientific analysis of the mechanical functions of the legs in walking, the Advisory Committee on Artificial Limbs of the National Research Council and the Veteran's Administration sponsored a research program of fundamental studies of locomotion at the University of California at Berkeley. In view of the range of variables involved in the mechanics of human locomotion a complete analysis of the problem is not possible at this time. The material presented in this paper is based on the investigations carried out at the University of California, and deals primarily with the force systems in and the displacements of the lower extremities during level walking of normal subjects.

Aviation

Flight Testing of Jet-Propelled Aircraft as Conducted by the Air Materiel Command, by N. R. Rosengarten, U. S. Air Force, Wright Field, Dayton, Ohio. 1948 ASME Annual Meeting Paper No. **48—A-90** (mimeographed).

The purpose of this paper is to acquaint those interested in the flight testing of jet-propelled aircraft with the methods used by the Flight Test Division of the Air Materiel Command.

The flight-test schedule of contractor's experimental aircraft consists of the following four phases:

Phase I consists of flights to insure satisfactory operation of the aircraft and its equipment which are not covered by special tests. These tests normally are conducted in accordance with a program prepared by the contractor and approved by the Air Materiel Command. The tests are primarily for the purpose of insuring that the aircraft is airworthy and that the equipment functions properly. If handling characteristics or the malfunctioning of any component parts such as dive brakes, flaps, bomb-bay doors, cabin pressure, etc., is of such a nature that engineering changes or redesign are suggested, but no hazard exists, modifications are not made at this time and the aircraft is turned over to the United States Air Force for preliminary evaluation tests.

Phase II tests are conducted for the purpose of determining whether further development of the aircraft is to be undertaken. These tests normally consist of an accelerated program to check all the contractor's guarantees such as high speed, cruising speed, rate of climb, service ceiling, take-off and landing distances and characteristics, fuel consumption, and the range of the airplane. They include some qualitative and quantitative stability tests.

Phase III tests, performed only on aircraft scheduled for production, are designed to overcome deficiencies discovered during Phase I and Phase II tests and include final flight demonstration tests. They are conducted at the contractor's plant in accordance with a program prepared by the contractor and approved by the Air Materiel Command. Tests are conducted to evaluate engineering changes made to improve the aircraft. In addition, such tests as spin tests, aerobatic, and stability tests are performed as required. The demonstrations also include dives to the maximum speed and load factors for which the particular aircraft was designed. All demonstration flights are witnessed by representatives of the Air Materiel Command.

Phase IV flight tests are conducted by the Flight Test Division at a location selected by the Air Materiel Command in accordance with a program prepared by the responsible project officer. The tests are accomplished for the purpose of evaluating all performance, stability and control, cooling, and all component parts so that the tactical organizations of the Air Force will have complete information available for tactical missions and training purposes. These tests require the most extensive instrumentation to make possible performance of such tests as air-speed and altimeter calibrations, level flight throughout the entire speed range, rate of climb and descent, fuel consumption, take-off, and landing, service ceiling, cooling, and stability and control.

It should be emphasized that the Phase

II and IV tests have several important objectives. The Phase II test indicates first whether the aircraft in question is worth producing; second, these tests result in data which offer a basis of comparing this particular aircraft with others for cleanliness of design, maneuverability, airworthiness, and other features which make for a desirable aircraft. These problems settled, the Phase IV test is the final evaluation for those combat and training organizations for which the aircraft is ultimately intended.

Industrial Instruments

A Classification of Linear Transfer Members, by H. L. Mason, Mem. ASME, Iowa State College, Ames, Iowa. 1948 ASME Annual Meeting paper No. **48—A-84** (mimeographed).

Linear dynamic behaviors are grouped in a classification consisting of four basic curves with three methods of modification and two methods of combination. It depends on responses to unit step disturbance, and related to Laplace transforms. Its utility is shown for members sequenced, manifolded, or looped, also for arbitrary disturbances and for reflex action.

Those who are trying to crystalize into a science the art of designing and operating automatic controls are faced with the need of a set of basic concepts which shall describe the components which make up such dynamical systems. These concepts must be exact, so that there can be no ambiguity in identifying dynamic behavior; must be universal, so that identical properties can be recognized whether the member is found in a distillation process, a pneumatic valve, or an electrical thermometer; must be compact, so that they will be convenient in everyday use; must be familiar, so that they can be grasped readily by the mechanic, the college student, the practicing engineer, and the theoretician.

It is the purpose of this paper to meet these requirements with a systematic and comprehensive description of the behaviors of linear transfer members. The term dynamical system is here applied to any interconnected grouping of physical apparatus whose behavior is describable by time-dependent variables, whether the nature of the energy transfer be translational, rotational, hydraulic, pneumatic, thermal, electromagnetic, electrical, electronic, or chemical. The paper is confined to cause-and-effect relations along one-dimensional network paths, rather than in a two-dimensional field or in multidimensional space. A disturbance, imposed at some point of the path, and proceeding from cause to effect, is imagined as exciting a consistent response in an adjoining variable. The action between them is said to be reflexed or bilateral if the responding variable can exert a reflexive effect on the disturbing variable; cascading or unilateral if it cannot. A path segment completely bounded by cascading actions is called a transfer member. The member is linear if several forms of disturbance acting at once produce a response equivalent to the sum of their separate responses.

Envelope Criteria for Control, by Abraham B. Soble, General Electric Company, Schenectady, N. Y. 1948 ASME Annual Meeting paper No. **48—A-85** (mimeographed).

In designing a control system, the engineer finds some parameters are fixed, while other parameters may be adjusted until desired performance is achieved. The purpose of this paper, is to find relationships between the adjustable and fixed parameters, such that desired transient performance is insured. Also treated are conditions to prevent transient resonance due to equal roots of the characteristic equation.

The mathematical theory is essentially an application of the Hurwitz-Routh conditions that the real parts of the roots of the characteristic equation be negative.

The principal advantages of the design method of this paper are as follows: (1) There is no computation of roots, (2) desired performance is guaranteed in advance.

In this paper the roots have been restricted to be within a preassigned rectangle.

Rubber Bearings

Laboratory Testing of Rubber Bearings, by J. R. Beatty and D. H. Cornell, B. F. Goodrich Research Center, Brooksville, Ohio. 1948 ASME Annual Meeting paper No. **48—A-110** (mimeographed).

Rubber bearings consist of a metal housing with a rubber lining operating on the metal journal of a shaft. These bearings are usually lubricated with water, but any fluid or sludge which may be present in the machine and which does not affect the rubber can be used to lubricate the bearings. The fluted rubber lining in a metal housing supports the metal journal, which is usually made of bronze, stainless steel, or other metals which are applicable to the general service requirements. Small bearings consist of a full-molded liner of rubber bonded to a brass shell. Because of construction and installation difficulties with larger bearings, separate strips or staves held securely in a housing are used to form the fluted lining of the bearing. A bearing stave consists of a section of rubber bonded to a brass strip and molded to shape. The individual staves are held in dovetailed slots cut around the periphery of the housing.

Rubber bearings are used extensively on the stern tube shafts of ships. They are also used in many other applications such as shaft bearings for dredges, pumps, or other equipment where they are lubricated either by running them submerged in a fluid or by pumping the fluid through the bearing.

Little investigation has been made of the use of various polymers and such performance factors as load, speed, and temperature, which are described in this article.

Tests have been developed to measure the important properties with reasonable speed and accuracy on laboratory and full-scale equipment. Research programs planned to utilize these tests have resulted in greatly improved bearings. Wear and coefficient of friction have been lowered and premature failure and noise found in unusual cases have effectively been eliminated by changes in construction of composition of the bearings.

Lubrication

Film Pressure Distribution in Grease-Lubricated Journal Bearings, by Gunther Cohn, Jun. ASME, The Franklin Institute Laboratories for Research and Development, Philadelphia, Pa., and Jess W. Oren, Jun. ASME, Armstrong Cork Company, Lancaster, Pa. 1948 ASME Annual Meeting paper No. **48—A-31** (in type; to be published in Trans. ASME).

Lubrication analysis may be divided into the following three broad fields: (1) Friction, which determines the power information; (2) running position, which establishes the minimum film thickness; and (3) pressure distribution, which defines the film outline.

Falling into the last division, the investigation described in this paper was undertaken to determine whether a hydrodynamic pressure exists in a grease-lubricated journal bearing, and if so, to obtain its magnitude and distribution.

From the results of this investigation, the following conclusions are drawn:

1 Grease can operate under hydrodynamic conditions.

2 Curves of pressure distribution of the grease film are flatter and extend over a greater arc than those of a comparable oil, showing that grease has less end leakage.

3 Speed affects the pressure distribution by shifting both leading and trailing edges of the grease film, but has little other effect.

The Load-Carrying Ability of Hydrodynamic Oil Films, by Arvid E. Roach, General Motors Corporation, Detroit, Mich. 1948 ASME Annual Meeting paper No. **48—A-74** (mimeographed).

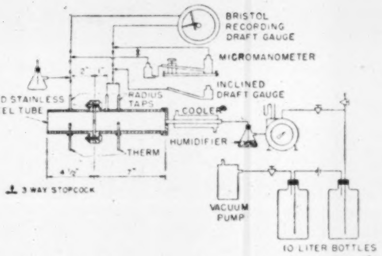
This paper presents a brief survey of the progress of the hydrodynamic theory of lubrication, particularly as it relates to the load-carrying capacity of journal bearings. Primary emphasis has been given to those aspects of the subject which are not adequately treated by the classical theory or which have not yet been brought into agreement with the theory.

Foremost among these aspects of the subject are the following: (1) There is as yet no single criterion for load-carrying capacity which satisfactorily fulfills the practical needs of the engineering profession; (2) no satisfactory method of measuring or computing the variation of lubricant viscosity within the load-supporting film; (3) no satisfactory method of measuring or computing the temperature gradient within the load-supporting film; (4) no comprehensive evaluation of possible physical and chemical actions between lubricants and bearing materials; and (5) no comprehensive treatment of the interaction between oil-film forces and transient elastic forces and of their effect on rotating shafts.

Fluid Meters

Air Flow Through Small Orifices in the Viscous Region, by H. R. Linden, Institute of Gas Technology, Technology Center, Chicago, Ill., and D. F. Othmer, Mem. ASME, Polytechnic Institute of Brooklyn, Brooklyn, N. Y. 1948 ASME Annual Meeting paper No. **48—A-93** (in type; to be published in Trans. ASME).

Experimental data for air flow through square-edged, circular orifices and their correlation with the pressure difference, the orifice diameter, and the air temperature are presented in nomographic form. The correlation holds well for small orifices with diameters ranging from $^1/_{16}$ to $^3/_{16}$ in., for pressure differences from 0.015 to 0.500 in. of water, and negligible velocity of approach. The air-temperature range within which the correlation can be applied is from 70 to 300 F, and corrections for barometric pressures from 27 to 32 in. of mercury can be made. The main use of this correlation will be found in its application to oil-burner design. By inclusion of the carbon-hydrogen-ratio criterion, the nomographic representation may be integrated with the system of combustion calculations, based upon the carbon-hydrogen ratio developed by the authors. The nomograph enables the designer to calculate the theoretical fuel rate at which any hydrocarbon fuel can be burned per square inch of air-orifice area at a given pressure difference across orifices of known diameter and at specified air temperature, air pressure, and air humidity.



EXPERIMENTAL SETUP FOR INVESTIGATING AIR FLOW IN VISCOUS REGION

Materials Handling

Training Engineers to Help Solve Materials-Handling Problems, by Harry J. Loberg, Cornell University, Ithaca, N. Y. 1948 ASME Annual Meeting paper No. **48—A-124** (mimeographed).

Materials handling is one part of the over-all production problem. Some authorities have estimated that 20 to 40 per cent of the cost of manufacturing is due to handling. Even if these figures are in error, it is an element worthy of consideration. At the present time, the prospective savings that can be made in the area of materials handling are greater than those that can be made in the areas of direct material or direct labor savings.

One must consider production as more inclusive than just making a product. The receiving, warehousing, and shipping of goods must be included. Distribution and all the elements required to produce a profit for the concern involved must be taken into consideration. These are the fundamentals which must be considered: (1) Elements of work simplification; (2) plant layout as related to the flow of material; (3) materials-handling equipment; (4) aspects of production control; (5) financial—economy involved; (6) elements of cost accounting.

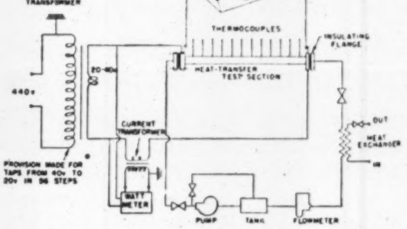
The magnitude of the job under consideration dictates the scope but not the procedures to be considered. They can be brought into play with a series of relatively small problems that illustrate basic principles and exercise the imagination of the student. The elaborate handling problems involving design of special equipment is beyond the scope of average training.

The fact that substantial savings can be made by using efficient methods makes it imperative that it is not ignored. But a good materials-handling program must be integrated with the factory layout and due consideration must be given to work simplification. Saddling a good handling method on inefficient layout and ignoring work-simplification tenets may show savings over present methods, but it may not be a good solution. Engineers trained to consider all the elements will help solve the problems more economically.

Heat Transfer

Heat Transfer to Water at High Flux Densities With and Without Surface Boiling, by Frank Kreith, Jun. ASME, and Martin Summerfield, Mem. ASME, California Institute of Technology, Pasadena, Calif. 1948 ASME Annual Meeting paper No. **48—A-38** (in type; to be published in Trans. ASME).

Surface coefficients of heat transfer have been obtained at rates of heat flux up to 3 Btu/(sq in.)(sec) for water flowing in stainless-steel tubes at mass-flow rates up to 5.4 lb per sec-sq in. The nonboiling forced-convection data were correlated by the Colburn equation $Nu_f = 0.023\ Re_f^{0.8}\ Pr_f^{1/3}$ within ± 5 per cent, but, with surface boiling, considerably larger Nu moduli were observed. When surface boiling occurred, the wall temperature was determined primarily by the pressure, being relatively insensitive to variations in velocity, heat flux, and bulk



FLOW AND WIRING DIAGRAM FOR ELECTRICALLY HEATED TEST SECTION temperature. The maximum heat flux that could be removed under given conditions was limited by an unsteady flow phenomenon. Data for pressure drop with and without nonboiling heat transfer are presented and correlated by an empirical viscosity correction factor.

Aerodynamic Heating and Convective Heat Transfer—Summary of Literature Survey,

by H. A. Johnson, Mem. ASME, General Electric Company, Schenectady, N. Y., and M. W. Rubesin, NACA Ames Laboratory, Moffett Field, Calif. 1948 ASME Annual Meeting paper No. 48—A-39 (in type; to be published in Trans. ASME).

The analytical and experimental information appearing in the literature for convective heat transfer at high velocities is summarized. Particular emphasis is given to heat transfer for submerged flow over flat plates, wedges, cones, and cylinders with a single reference to flow in pipes. The evidence presented supports, as a fundamental heat-transfer relation, the modified Newton's law of cooling

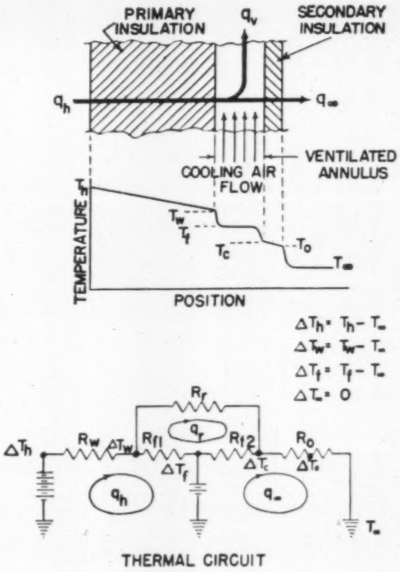
$$q = hA[t_w - (t_o + ru_o^2/2gJc_p)]$$

where the term $ru_o^2/2gJc_p$ accounts for the influence of frictional dissipation and is readily evaluated when the recovery factor r is known. A second and very important result is the evidence given to show that the heat-transfer coefficient h, is independent of the magnitude of the frictional-dissipation term. Data are presented for the recovery factor and heat-transfer coefficient for high-speed subsonic and supersonic-flow velocities. It should be noted, however, that heat transfer by radiation is not considered here as it would be treated in the usual manner for heat transfer without frictional dissipation.

A Ventilated Thermal-Insulation Structure for High-Temperature Marine Power Plants,

by A. L. London, Mem. ASME, and C. R. Garbett, Stanford University, Stanford, Calif. 1948 ASME Annual Meeting paper No. 48—A-46 (in type; to be published in Trans. ASME).

This paper presents a method of design for a ventilated thermal-insulation structure suitable for high-temperature marine power plants. Such a structure is of substantially smaller thickness than the conventional type when designed for the same heat leak to the machinery space. This reduction, however, is obtained at the expense of increased heat leak from the thermodynamic working substance. Nevertheless, the cost in terms of plant fuel consumption may not be excessive. The ventilating air, which carries away the greater portion of the energy, is shown to have moderate requirements of flow rate, number of ducts, and blower power. The conclusions of the analysis are supported by some preliminary test results.



VENTILATED THERMAL-INSULATION STRUCTURE, SHOWING APPROXIMATE TEMPERATURE DISTRIBUTION AND THERMAL CIRCUIT

Supersonic Convective Heat-Transfer Correlation From Skin-Temperature Measurements on a V-2 Rocket in Flight,

by W. W. Fischer, Jun. ASME, and R. H. Norris, Mem. ASME, General Electric Company, Schenectady, N. Y. 1948 ASME Annual Meeting paper No. 48—A-54 (in type; to be published in Trans. ASME).

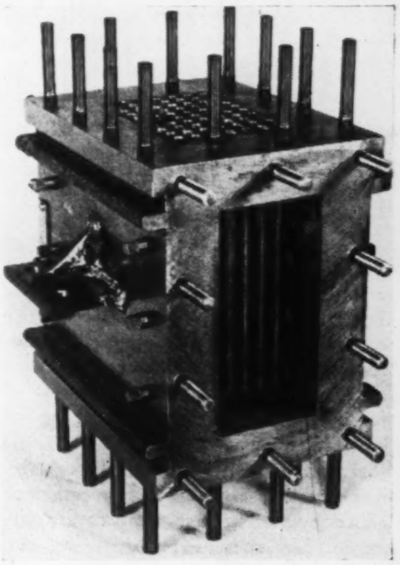
Coefficients of convective heat transfer have been evaluated by analysis of the skin-temperature measurements made at several points on the nose of a V-2 (German A-4) rocket during flight in New Mexico. On one side, the surface of the nose was smooth but on the other side, 4 in. from the nose tip, a transverse ridge about $^1/_8$ in. high, was purposely provided as a turbulence promoter.

The test results are compared in dimensionless form with various proposed correlations for both laminar and turbulent conditions of the boundary layer. The test results, thus correlated, seem to justify the following conclusions: (1) Boundary-layer transition seems to be more dependent, at supersonic speed, on Mach number than on Reynolds number. (2) The theoretical heat-transfer correlation for a laminar layer is confirmed by the appropriate sets of test points to the estimated order of accuracy of the test. (3) For turbulent layer conditions, the subsonic correlation for a flat plate provides better agreement with the supersonic test results than does Eber's correlation, but there still remains a range of uncertainty as to the best choice of temperature for evaluation of the air properties.

A Study of Three Tube Arrangements in Unbaffled Tubular Heat Exchangers,

by O. P. Bergelin, E. S. Davis, and H. L. Hull, University of Delaware, Newark, Del. 1948 ASME Annual Meeting paper No. 48—A-34 (in type; to be published in Trans. ASME).

Pressure-drop and heat-transfer tests, using a medium-viscosity oil in viscous flow across vertical tubes in three unbaffled exchangers, are reported in the course of a research program on tubular exchangers. The three once-flow-through units have, respectively, equilateral triangular, in-line square, and staggered square tube arrangements, but, in all other respects, are as nearly identical as possible. Heat-transfer data for three bulk-oil temperatures and a constant, but lower, tube-wall temperature, and both isothermal and nonisothermal pressure-drop data at three temperature levels are reported. The two staggered-tube arrangements provide greater heat transfer at a given pumping power loss than the in-line arrangement in the region of



MODEL EXCHANGER WITH IN-LINE SQUARE ARRANGEMENT OF TUBES viscous flow, but this superiority decreases at higher velocities and may disappear in turbulent flow as previous data have indicated. A correction is presented for the effect of viscosity gradient upon friction during heat transfer but this correction does not allow for free convection or nonuniform flow.

An Analytical Investigation of Convective Heat Transfer From a Flat Plate Having a Stepwise Discontinuous Surface Temperature, by M. W. Rubesin, NACA Ames Aeronautical Laboratory, Moffett Field, Calif. 1948 ASME Annual Meeting paper No. **48—A-43** (mimeographed).

Approximate expressions are determined analytically for the local and average thermal conductances for heat transfer between a fluid and a flat plate. The plate is considered parallel to the direction of flow and has a stepwise discontinuous surface temperature. Both laminar and turbulent boundary layers are considered. Special cases of the final expressions obtained are compared with existing analytical and experimental results. On the whole, these comparisons are favorable. A numerical example is presented which includes the two possible temperature discontinuities, that is, a sudden increase and a sudden decrease in the plate surface temperature. To explain the effects on the thermal conductances caused by the surface temperature discontinuities, a curve of temperature distribution in the boundary layer directly behind the surface-temperature discontinuity is also presented for this example.

An Analysis of the Heat Transfer to Turbulent Boundary Layers in High-Velocity Flow, by R. A. Seban, Mem. ASME, University of California, Berkeley, Calif. ASME Annual Meeting paper No. **48—A-44** (mimeographed).

The method of the analogy as employed by von Kármán, and by Boelter and Martinelli, is used for the calculation of the heat-transfer coefficients to an incompressible fluid flowing turbulently within a pipe or over a flat plate, the effect of the dissipation of flow energy being included in the analysis.

Stanton number expressions are derived on the basis of a heat-transfer coefficient defined by an effective temperature difference, and these expressions are the same as obtained for a flow in which the effect of dissipation can be neglected. The effect of the dissipation is thus indicated as localized in the expression of the temperature difference, a result the same as obtained for laminar boundary-layer flow.

The analysis yields a specification of the recovery factor and indicates the effect of the dissipation to be localized in the expression for the temperature difference. The Stanton number expression remains the same as for heat transfer in the absence of dissipation and in this regard the effect of the dissipation is the same for laminar and turbulent boundary layers. The recovery factor predicted for turbulent flow is a function of both the Prandtl and Reynolds numbers, while that for laminar incompressible flow is a function of the Prandtl number alone. The predicted recovery factors are higher than measured values, a discrepancy that might possibly be rationalized by the specification of a diffusivity ratio greater than unity. Presently available data are too meager for a decisive statement in this regard.

Magnetic Inspection

Magnetic-Particle Testing, by L. B. Jones, Mem. ASME, Altoona, Pa. 1948 ASME Annual Meeting paper No. **48—A-79** (mimeographed).

Magnetic-particle inspection is a method for detecting cracks, discontinuities, and other defects in magnetic material by the application of magnetic forces and paramagnetic particles. The articles used as a medium for inspection gave much greater permanence than air and therefore form much better conductors for magnetic lines of force. Consequently, when brought into a magnetic field with lines of force passing through the air, they tend to arrange themselves along such lines. If a magnet is partly broken at right angles to its axis, the parts immediately adjacent to the break or crack will tend to assume opposite polarity, and form a local leakage field. An inclusion, or piece of foreign matter embedded in the steel, will tend to produce the same effect as a break or crack. This fact forms the basis for magnetic-particle inspection.

By the dry method of testing, the piece is first magnetized, and the magnetic particles are then applied to the surface under examination. The technique of application varies considerably with the kind of piece, condition of the surface, intensity of flux, and character of defect suspected. The desired effect is maximum mobility of articles which is aided, according to conditions, by dusting the powder into the air near the surface, vibrating the surface by tapping, or taking advantage of alternating-current flux.

By the wet method, the particles are first mixed with a liquid, preferably a light oil such as kerosene, or machine oil having some body but low viscosity. The piece is first magnetized, and a mixture of oil and particles poured over it, after being thoroughly stirred. The basis of this method is the high degree of mobility of particles in a liquid medium.

Fluorescent-Liquid Inspection, by Ray McBrian, Denver and Rio Grande Western Railroad, Denver, Colo. 1948 ASME Annual Meeting paper No. **48—A-80** (mimeographed).

Black light is the term popularly applied to the invisible radiant energy in that portion of the ultraviolet spectrum just beyond the blue of visible light. It is the range between 3500 and 4000 Angstrom units. Fluorescence is the term used to describe effects produced by certain materials which exhibit the property of emitting visible light from within themselves during exposure to black light.

For inspecting magnetic materials, a special Magnaglow paste is made to be used in the wet method of Magnaflux inspection. The paste is mixed with a suitable oil to form a suspension of fluorescent ferromagnetic particles. A suitable magnetic field is induced in the part to be inspected. Sudden interruptions of the magnetic field by discontinuities in the part locally, crowd some of the magnetic flux outside the part. The resulting leakage fields attract and hold the particles when the suspension is applied to the part, thus forming definite indications of the location, extent, and shape of the discontinuities.

This magnetic-fluorescent method of inspection has many advantages which railroads can and do use to locate defects between threads, inside bores, in irregular shapes, and sharp change of sections. Application can be found in such Diesel parts as bolts, crankshafts, connecting rods, etc. Many steam-locomotive parts also can be similarly inspected.

For nonmagnetic materials, the fluorescent-penetrant method of inspection commonly known as Zyglo is used. The part to be inspected is first coated with a fluid which has the properties of penetration and fluorescence under black light. After application, the parts are set aside for varying periods of time. Excess penetrant drains off during this period and is recovered. Inspection is usually made under a darkroom type of hood.

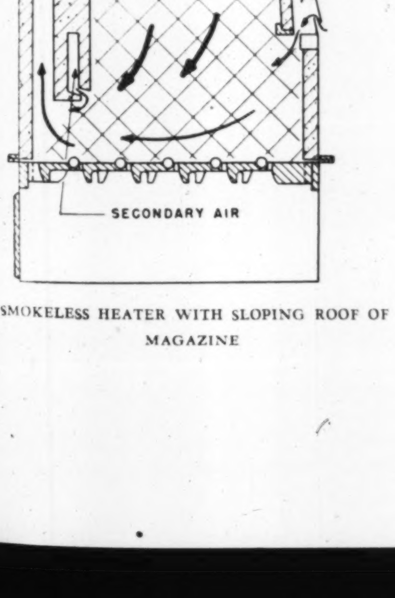
Smokeless Coal Stove

The Development of a Design of Smokeless Stove for Bituminous Coal, by Bertrand A. Landry and Ralph A. Sherman, Members ASME, Battelle Memorial Institute, Columbus, Ohio. 1948 ASME Annual Meeting paper No. **48—A-119** (mimeographed).

This paper presents an account of an extended systematic investigation which resulted in the development of a method for burning bituminous coals in nonmechanical hand-fired heaters or stoves with substantially smokeless operation. The research was sponsored by Bituminous Coal Research, Inc., and a group of stove manufacturers.

An experimental investigation of the three principles of combustion in fuel beds led to the adoption of the cross-feed principle. Primary air, admitted above the grate, flows across the bed as the coal moves downward from the magazine. A small amount of air admitted above the charge of coal flows downward through the bed and, by oxidation of the surface of the pieces, prevents caking and makes self-feeding possible with a minimum of poking.

At an arch at the end point of exit of the gases from the fuel bed, secondary air is admitted through a slot which directs the air toward the bed. In this way, complete mixing of the air with the combustible gases is obtained and the maintenance of a temperature high enough for ignition is favored.



SMOKELESS HEATER WITH SLOPING ROOF OF MAGAZINE

The design of a special grate and the research to prevent puffing, a difficulty often encountered with magazine heaters, are described. The principles of a calorimeter room in which the output of a space heater can be directly measured are presented. Data given show the thermal efficiency of a manufacturer's model of the heater which had an output of 41,000 Btu per hr to be 65 per cent.

The design principles developed are applicable also to warm-air furnaces and residential boilers and are now in process of being applied to these types of equipment.

Hydraulics

The Parallel Development of Heavy Self-Contained Hydraulic Presses in The United States and Great Britain, by F. H. Towler, Towler Bros. (Patents), Ltd., and Electraulic Presses Ltd., Rodley, near Leeds, England. 1948 ASME Annual Meeting paper No. **48—A-33** (in type; to be published in Trans. ASME).

The object of this paper is to survey the parallel development of heavy self-contained hydraulic presses in the United States and Great Britain in the hope that an exchange of ideas may be helpful to future development in both countries. The self-contained press has been made possible by the development of a compact high-speed pump using oil as the hydraulic medium; and the construction of the pump has a considerable influence on the design of the press. In the United States the tendency has been to use pumps of the rotary-valve type operating at a maximum pressure of about 3000 psi, with a comparatively thick oil of around 300 Saybolt at 100 F. In Great Britain there is a growing tendency to use pumps of the seated-valve type capable of a working pressure of 7000 psi, and using a thin oil of 60 Saybolt at 100 F. The relative advantages and disadvantages are discussed.

Elements of Graphical Solution of Water-Hammer Problems in Centrifugal-Pump Systems, by A. J. Stepanoff, Mem. ASME, Ingersoll-Rand Company, Phillipsburg, N. J. 1948 ASME Annual Meeting paper No. **48—A-89** (mimeographed).

Since the publication of the "Symposium on Water Hammer" by the ASME in 1933, considerable progress has been made abroad in the development of the graphical method of solution of water-hammer problems. Although based on the same fundamental relationships as the analytical solutions, the graphical method does not require an exact knowledge of the theoretical background and at the same time it gives a clear mental pattern of the events which enables one to use it with confidence for solution of practical problems.

Early studies of water-hammer problems were carried out almost entirely in connection with water-turbine applications. Water-hammer problems in the centrifugal-pump field are more numerous and varied, but due to the smaller size of units the effects of water hammer were learned by experience, damage being repaired at a relatively low cost. Centrifugal-pump designers and users are little familiar with water-hammer theory. Fear of involved mathematical treatment has been a major factor to such neglect.

The author attempts to present the water-hammer theory and the graphical method of solution in its simplest terms. This will enable a pump engineer to recognize the conditions leading to water hammer, to estimate the possible maximum pressure rise and, when necessary, to provide means to reduce the pressure rise to a safe limit.

The Dynamics of Cavitation Bubbles, by Milton S. Plesset, California Institute of Technology, Pasadena, Calif. 1948 ASME Annual Meeting paper No. **48—A 107** (mimeographed).

Three regimes of liquid flow over a body are defined: (1) noncavitating flow; (2) cavitating flow with a relatively small number of cavitation bubbles in the field of flow; and (3) cavitating flow with a single large cavity about the body. The assumption is made that, for the second regime of flow, the pressure coefficient in the flow field is no different from that in the noncavitating flow. On this basis, the equation of motion for the growth and collapse of a cavitation bubble containing vapor is derived and applied to experimental observations on such bubbles. The limitations of this equation of motion are pointed out, and include the effect of the finite rate of evaporation and condensation, and compressibility of vapor and liquid. A brief discussion of the role of "nuclei" in the liquid in the rate of formation of cavitation bubbles is also given.

A distinctive feature of the hydrodynamics of liquids is the possibility of the coexistence of a vapor, or gas phase with the liquid phase. Such two-phase flow is usually called cavitating flow, although it could as well be characterized as liquid flow with boiling.

Cavitating flow has great theoretical interest, in addition to the hydrodynamics involved, because of the relation of this flow condition to the physical-chemical properties of the liquid. The practical significance of caviattion is of course clear: The drag of submerged bodies moving through a liquid rises when cavitation appears; similarly, the efficiency of pumps, turbines, and propellers drops with the development of cavitation; and the damage which may be produced by cavitation in these devices is well known.

Power

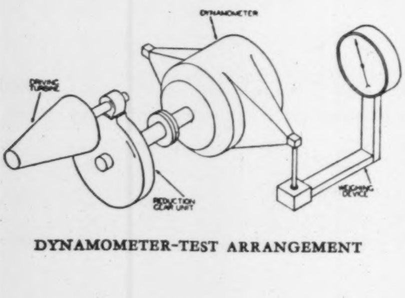
Marine-Propulsion Gear Testing at the Naval Boiler and Turbine Laboratory, by Ivan Monk, Philadelphia Naval Shipyard, Philadelphia, Pa. 1948 ASME Annual Meeting paper No. **48—A-50** (in type; to be published in Trans. ASME).

This paper describes the testing phases of the propulsion-gear development program of the United States Navy. Full-sized reduction-gear units are tested to destruction under controlled conditions. The facilities and procedures employed in these tests are described, together with some of the problems encountered. Results are presented from tests in which four destroyer-escort reduction-gear units were able to transmit more than three times their designed full power before failure occurred.

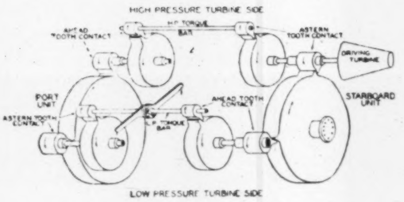
Gears are tested at the laboratory for many purposes but these may be divided into the following general categories: (*a*) Contract acceptance tests; (*b*) development tests.

The following two methods of testing gears are employed at the laboratory: (*a*) Dynamometer testing; (*b*) torque testing.

When the present gear-testing program was being planned, it was generally agreed that one of the best methods of determining the weak points of a gear was to operate it at progressively increasing loads until failure occurred. As a result, most of the gears tested at the laboratory ultimately have been run to destruction.



DYNAMOMETER-TEST ARRANGEMENT



FRONT-TO-FRONT TORQUE-TEST ARRANGEMENT

(Both units rotate in ahead directions.)

During the erection and operation of a gear test, every effort is made to eliminate all variables except those under investigation.

Due to the large diversity of designs and characteristics of the gears tested to date the results have varied between wide limits. However, each test has furnished valuable information which may be applied to future designs. In general, it may be stated that the tooth loadings permitted by Navy specifications during World War II were conservative and can be increased without compromising reliability.

Power-Plant Cycle Evaluation, by J. K. Salisbury, Mem. ASME, General Electric Company, Schenectady, N. Y. 1948 ASME Annual Meeting paper No. **48—A-57** (mimeographed).

Thermodynamic losses in the heater system of a steam power-plant cycle are analyzed. All heater systems are rated with respect to an "ideal" heater system. Simple algebraic formulations permit determination of arrangement loss, distribution loss, and loss due to terminal difference and pressure drop in any heater cycle. Miscellaneous corrections to cycle heat rate are described and two typical corrections analyzed. The paper constitutes a new basic approach to analysis of feedwater heating cycles, based largely on a simplifying assumption, valid for the purpose.

This work is a sequel to a paper by the author published in Transactions of the ASME, vol. 64, 1942, p. 231, outlining a method of analysis for steam power-plant cycles. The previous paper considered major parameters of steam-cycle performance, using several simplifying assumptions. All heaters were considered to be contact-type heaters having identical condensate enthalpy rises. No pressure drop in extraction lines or terminal difference in heaters were taken into account. Deviations of actual cycles from this ideal cycle are investigated in the present paper and methods illustrated for determining the loss which results.

Cyclic Heating Test of Main Steam Piping Joints Between Ferritic and Austenitic Steels, Sewaren Generating Station, by H. Weisberg, Mem. ASME, Public Service Electric and Gas Company, Newark, N. J. 1948 ASME Annual Meeting paper No. **48—A-87** (mimeographed).

Stainless-steel piping and valves are new in power-plant practice. While various austenitic steels have been used for several years in oil-refinery and other high-temperature industrial process piping, these applications are at low pressures requiring relatively thin-wall pipe. Also, the expected life is comparatively short. Sewaren Generating Station of the Public Service Electric and Gas Company in New Jersey will be the first steam power plant to operate at 1050 F initial steam temperature, the steam pressure being 1500 psi. Both the General Electric and Westinghouse 100,000-kw turbines have been furnished with austenitic-steel valves and inlet steam piping. The Combustion boilers, however, are provided with 3 per cent chrome, 1 per cent moly (ferritic) steel piping from the superheaters to the turbines.

A cyclic heating test of several full-size heavy-wall pipe joints between austenitic and ferritic steels required for the piping of the Sewaren Station is described. It is concluded that sound welded joints can be made between these dissimilar materials and that such joints will withstand the effects of temperature changes which may be expected to occur in modern power-plant service.

Corrosion of Boiler Generating Tubes at Battersea and Deptford West Generating Stations, by R. L. Rees and E. A. Howes, British Electricity Authority, London, England. 1948 ASME Annual Meeting paper No. **48—A-100** (mimeographed).

This paper is prompted by the remarks of Messrs. Mitsch and Yeager in their closure to the discussion of the papers on the corrosion experienced in certain boilers, reported in the Transactions of the ASME, vol. 69, 1947, pp. 479–503.

The type of corrosion described by the authors of these papers has been experienced for the last few years in two generating stations of the London Power Company Ltd., at Deptford West, and Battersea. The former station operates at a pressure of 375 psi while the Battersea "A" station operates at 625 psi.

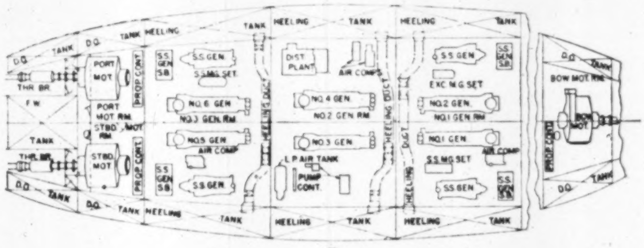
At Deptford and Battersea the alkalinity of the boiler water has been increased to a minimum of 50 ppm $CaCO_3$ to pH 8 and the phosphate concentration was simultaneously increased to approximately 20 ppm in order to increase the buffer capacity in the films. Tannin was introduced at Deptford but was found to be rapidly decomposed at the operational temperature at Battersea. Since 1945 the rate of corrosion has been greatly reduced; at Deptford the corrosion has virtually stopped. No further failures have occurred, although some evidence of corrosion has been experienced at Battersea, but on a considerably reduced scale. It is interesting to note that copper is still found in the boiler sludges and the metallic copper content often reaches 40 per cent of the sludge. There has been no sign of this type of corrosion in the extra-high-pressure boilers, but balls of hard iron oxide, chiefly magnetite, encased in a skin of metallic copper, have been found. These balls have been up to $^{1}/_{2}$ in. in diam.

Machinery Installation of the "Wind" Class Coast Guard Icebreakers, by Captain E. H. Thiele, USCG, Troy, N. Y. 1948 ASME Annual Meeting paper No. **48—A-111** (mimeographed).

This paper has been prepared as a complement to a paper given by Rear Admiral Harvey F. Johnson before the Society of Naval Architects and Marine Engineers, entitled, "Development of Icebreaking Vessels for the U. S. Coast Guard." Admiral Johnson's paper touched on all phases of the design of Coast Guard icebreakers, but, of necessity, because of the broad scope of his paper, dealt very briefly with the problems of machinery.

It is the purpose of this paper to describe problems encountered in the development and design of the machinery for Coast Guard icebreakers. In a special vessel of this type every piece of machinery from the main engines to the deck machinery presented problems to be overcome which were peculiar to the design and differed materially from standard marine practice. The paper makes no attempt to go into great technical detail of the various aspects of the different machinery installations, but does attempt to point out the differences and the problems encountered which have not been encountered before in conventional marine and naval vessels.

To acquaint the reader with the work that these special vessels have done, a brief report of the operating experiences has been incorporated.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FORWARD

MACHINERY ARRANGEMENT, WIND CLASS

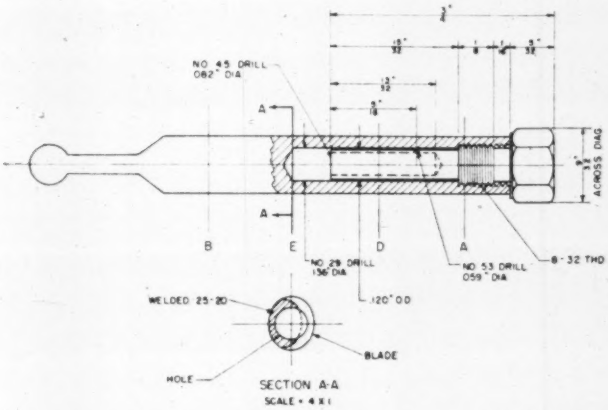
Gas-Turbine Materials

Comparison of High-Temperature Alloys Tested as Blades in a Type-B Turbosupercharger, by William C. Stewart and H. C. Ellinghausen, U. S. Naval Engineering Experiment Station, Annapolis, Md. 1948 ASME Annual Meeting paper No. **48—A-96** (mimeographed).

A series of jet tests, utilizing gas produced from the combustion of Diesel fuel oil, as a means for comparing the resistance of a number of high-temperature alloys to hot gas impingement, are described. The deficiencies of this method for simulating conditions in a gas turbine are discussed.

The main part of the paper is concerned with comparative tests of a number of high-temperature alloys when tested in the form of blades in a type-B turbosupercharger. The test rotor contained 142 blades representing 12 different alloys. Both wrought and precision-cast blades were included. Tests were made at eight temperatures ranging from approximately 1200 to 1500 F, test runs at each temperature being 50 to 150 hr duration except in the case of the 1500-F test run which is being continued for 1000 hr.

After several of the test runs, measurements were made to determine the amount of permanent extension in the blades and disk. The extension of the blades and disk accompanying progressively higher-testing temperatures is shown graphically. A procedure for correlating the metal temperature of the blades with that of the combustion gas in the nozzle chamber of the supercharger is described.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CAPSULE MOUNTED IN END OF TURBINE BLADE FOR HOLDING TEMPERATURE-INDICATING POWDER OR ALLOY

Changes in Internal Damping of Gas-Turbine Materials Due to Continuous Vibration, by G. B. Wilkes, Jr., General Electric Company, Lynn, Mass. 1948 ASME Annual Meeting paper No. **48—A-95** (mimeographed).

Tests on four gas-turbine-bucket materials have been conducted at elevated temperatures which involved the measurement of the pressure required to vibrate specimens in a pneumatically driven fatigue machine. The pressure is assumed to be a qualitative measure of the internal damping of the material.

It was found that at a peak stress of 40,000 psi, nickel and cobalt-base alloys showed a minimum damping near 800 F and a sharp rise between 1350 F and 1500 F. Two iron-base alloys had a maximum damping between 800 F and 1200 F, a slight dip at 1350 F, and a sharp rise at 1500 F.

Two of the materials indicated excessively high damping at 1200 F and above at stresses below their fatigue limit. This high value, however, became rapidly smaller as vibration was continued to the extent that they finally showed the lowest values of the four materials. This means that damping data obtained by more orthodox means in short times may, in some cases, be very greatly in error if used in choosing materials for gas-turbine buckets. It appears that this could be a rather important factor in those designs where internal damping of the buckets is believed to be a major factor in limiting vibration.

These results are based on a minimum of data and are therefore subject to some revision as more data are accumulated. Probably the largest single source of error is the fact that a number of successive tests were made on a single bar and the results themselves indicate that past history may have a marked effect on behavior.

Heat Engines

Heat Engines Based on Wave Processes, by Arthur Kantrowitz, Cornell University, Ithaca, N. Y. 1948 ASME Annual Meeting paper No. **48—A-133** (mimeographed).

Starting about the turn of the century, a series of heat engines have appeared in which combustion products have been used directly to compress the fresh gas needed for combustion. It has been appreciated more recently, that this interaction of one gas on another must be described as a wave process. The wave process was first treated essentially as an acoustic problem. It is shown in this paper that this approximation is inadequate for the high pressure waves which are needed for application to heat engines. More accurate methods of treating these high pressure waves by the method of characteristics are developed in this paper. Comparison of the results obtained by the method of characteristics with experiment are given. Application of this method to the design of cycles for these engines is presented.

In the machines which are discussed, the first gas is introduced from a nozzle opposite one end of a tube and forces the second gas into a pickup at the other end of the tube. This process can be made very nearly continuous by mounting a bank of such tubes on a rotor so that fresh tubes continually move into a position opposite the nozzle and the pickup.

Metals Engineering

A Reconsideration of Deformation Theories of Plasticity, by D. C. Drucker, Mem. ASME, Brown University, Providence, R. I. 1948 ASME Annual Meeting paper No. **48—A-81** (mimeographed).

Deformation theories of plasticity for strain-hardening materials are defined as those which postulate that the components of elastic and permanent strain are completely determined by the existing components of stress. The assumption is made that there is some criterion, in terms of stress, for loading or increase in plastic deformation. A common supposition of this nature is that the permanent strain will increase when the octahedral shearing stress increases.

It is shown that no matter what the loading criterion, these deformation theories of plasticity lead to the unacceptable conclusion that large (finite) changes in the components of permanent strain may accompany infinitesimal increases in loading despite strain hardening. Simple illustrations are given and it is demonstrated that an incremental or so-called flow theory eliminates this undesirable feature.

Quality Control

Statistical Inspection Pictures Cut Material Procurement Costs, by Dorian Shainin, United Aircraft Corporation, East Hartford, Conn. 1948 ASME Annual Meeting paper No. **48—A-88** (mimeographed).

In the process of determining the disposition of a lot or batch of material received from a vendor, the inspector conducts a statistical sampling of each specification involved and records a picture, or plot, of the requirement as it is found in that lot. Three important features of this picture, or "lot plot," are the average value, the spread or dispersion of the values, and the shape of the distribution values which are plotted against their frequency of occurence.

The mechanics of the lot-plot-sampling inspection plan has solved many purchasing and vendor-relations problems as well as improved upon the accuracy attainable by 100 per cent inspection. While based upon a background of mathematical probability, the operation of the plan is made extremely simple by the use of convenient charts. Its success so far is measured by a 29 per cent reduction in receiving inspection costs, and a reduction to zero of rejections from assembly or service operations of improperly manufactured parts carrying a total of 16,000,000 specification requirements which have been processed in one year of operation.

ASME Transactions for December, 1948

THE December, 1948, issue of the Transactions of the ASME, which is the *Journal of Applied Mechanics*, contains the following:

TECHNICAL PAPERS

The Partitioning of Matrices in Structural Analysis, by S. U. Benscoter (Paper No. 48—APM-7)

Flow of a Compressible Fluid Through a Series of Identical Orifices, by C. S. L. Robinson (Paper No. 48—APM-4)

The Decay of Isotropic Turbulence, by F. N. Frenkiel (Paper No. 48—APM-5)

Centrifugal and Thermal Stresses in Rotating Disks, by W. R. Leopold (Paper No. 48—SA-1)

Vibration of a Cantilever Beam With Prescribed End Motion, by G. A. Nothmann (Paper No. 48—APM-3)

Large Cylindrical Bending of Rectangular Plates, by H. A. Lang (Paper No. 47—A-145)

Investigations of the Flow in Curved Ducts at Large Reynolds Numbers, by J. R. Weske (Paper No. 47—A-149)

Thermodynamic Properties of Gas Mixtures Encountered in Gas-Turbine and Jet-Propulsion Processes, by Joseph Kaye (Paper No. 47—A-1)

Large Deformations of an Elastic Solid, by E. G. Chilton (Paper No. 48—APM-8)

Gyroscopic Effects on the Critical Speeds of Flexible Rotors, by R. B. Green (Paper No. 48—SA-3)

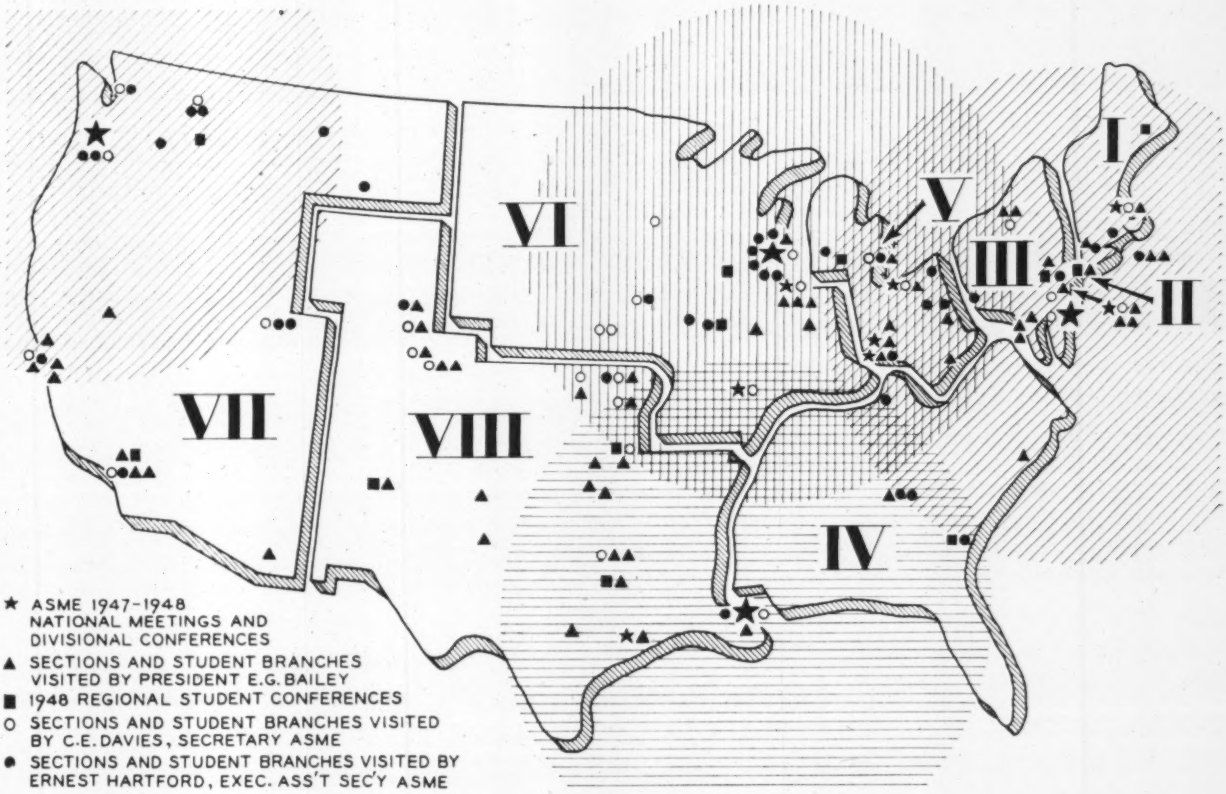
Heat-Exchanger Tube-Sheet Design, by K. A. Gardner (Paper No. 47—A-104)

DISCUSSION

On previously published papers by George Gerard; Martin Goland and Y. L. Luke; R. S. Levy; R. B. Meuser and E. E. Weibel; M. C. Shaw; and H. M. Trent

BOOK REVIEWS

GEOGRAPHICAL PATTERN OF MAJOR ASME ACTIVITIES IN 1947–1948


I
II
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★ ASME 1947-1948 NATIONAL MEETINGS AND DIVISIONAL CONFERENCES
▲ SECTIONS AND STUDENT BRANCHES VISITED BY PRESIDENT E.G. BAILEY
■ 1948 REGIONAL STUDENT CONFERENCES
○ SECTIONS AND STUDENT BRANCHES VISITED BY C.E. DAVIES, SECRETARY ASME
● SECTIONS AND STUDENT BRANCHES VISITED BY ERNEST HARTFORD, EXEC. ASS'T SEC'Y ASME

DURING THE YEAR, MAJOR ASME EVENTS WERE HELD IN THE INDUSTRIAL CENTERS OF THE NATION

(Shaded areas around the four national-meeting cities demonstrate the ASME policy of holding each year at least one national meeting within one-day travel time from the home communities of most ASME members.)

To ASME Members:

THE COUNCIL REPORTS FOR 1948

High Lights

GENERAL HIGH LEVEL

The Society completed its sixty-eighth year with continued record of useful activities.

NATIONAL

Progress made in formulating ideas about the organization of the engineering profession.

INTERNATIONAL

Continued program of international co-operation involving interchange of information and personnel. Good progress made with Great Britain and Canada unifying screw threads.

PUBLICATIONS

New plan installed; *Applied Mechanics Reviews* established.

MEETINGS

Twelve national meetings and conferences at good technical level. Improvement in getting papers in advance improves discussion and attention given to meetings by press.

REGIONAL ADMINISTRATION

Third year of new administration proves worth; provides better service to Sections and student branches.

STUDENT ACTIVITIES

124 student branches; 11 regional conferences; 678 meetings; 5000 increase in membership.

MEMBERSHIP

New high, 26,576 members.

THIS report summarizes the activities of The American Society of Mechanical Engineers as reported to the Council by the standing and special committees, boards, and Society representatives on other bodies. Complete reports are available to members on request.

The technological advances in mechanical engineering which reached a high level during the year were made public through meetings and regular publications and through the reports of its research and other technical committees. Because of their diversity and extent, it is impossible to do justice to them in this report.

In the following paragraphs, emphasis is given to three categories of Society usefulness: Service to the nation and the engineering profession; service of an international nature; and service to the members. Reports on Society administration and finances complete the report.

The success of the year is due to the contributions of many members, to whom the Council expresses grateful appreciation.

I NATIONAL AND PROFESSIONAL ACCOMPLISHMENTS

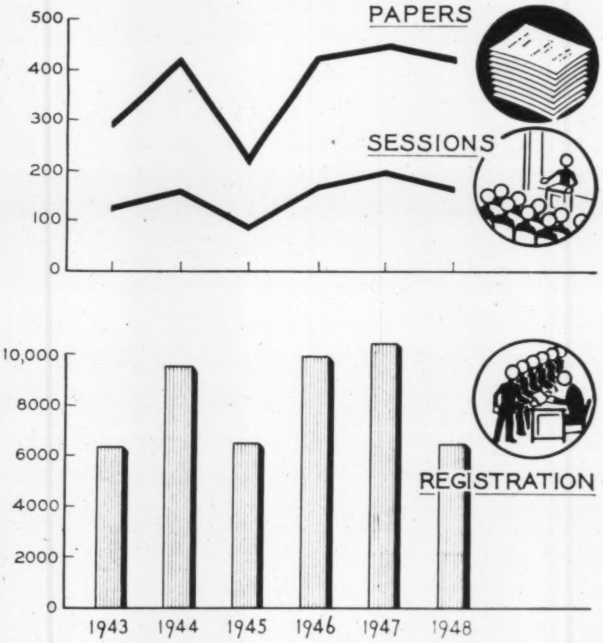
The Society serves the public and the engineering profession through its committees and members, and through the Engineers Joint Council[1] and the Engineers' Council for Professional Development.

ORGANIZATION OF THE PROFESSION

For several years Engineers Joint Council has devoted attention to the feelings expressed by many engineers that some changes in the organization of the profession seemed imperative if the profession were to improve the manner of discharging its responsibilities. Several types of organization are possible: (1) A federation of societies like the American Engineering Council; (2) an agency of representatives of local engineering societies to deal with problems at the national level; and (3) a national society devoted to the public problems of engineering, but made up of individual memberships. During the year, Engineers Joint Council received a report which outlined the details of a national agency of local bodies. This report was sent to the Sections with the request that the plan be discussed in the Regional Administrative Committees and that a final view be expressed in the Regional Delegates Conference held at Milwaukee.

The Regional Delegates Conference reported to the Council at Milwaukee that after considerable discussion in which a good deal of diversity of opinion developed, the Conference passed two resolutions. The first recommended that Council propose to continue efforts toward the organization of a national engineering council to co-ordinate the activities of the societies at the local, state, and national levels, to speak for engineers, and the profession, in matters of broad significance. The second resolution suggested to Council that before any effort is made toward the active formation of an over-all national society the aims and purposes of such a society be clearly defined, the desires of the individual members of the present Societies be consulted, and the basis upon which an over-all society can be effectively sold to the membership of the present societies be determined. If such an organization is formed, among its fundamental aims should be the improvement of the political and economic status of the engineering profession.

Pending the development of the national council suggested, steps have been taken to strengthen the Engineers Joint Council. A new constitution is awaiting adoption and a new committee structure is being developed.



SOCIETY ACTIVITIES DURING THE YEAR DROPPED FROM THE PEAK YEAR OF 1947. LARGE DROP IN REGISTRATION WAS DUE PRIMARILY TO THE CHANGE OF THE ANNUAL MEETING FROM NEW YORK, N. Y., TO ATLANTIC CITY, N. J.

To improve liaison between national societies working in the field of mechanical engineering, the Society sponsored a second Mechanical Engineering Educational Conference in March, 1948, which was attended by representatives of eight national societies. Education and the accrediting of engineering schools were the principal subjects discussed. It was agreed that the Conferences be continued and that in 1949 the meeting be devoted to the work of Engineers' Council for Professional Development.

PROFESSIONAL DEVELOPMENT

The Society contributed to the professional development of the young engineer through the Engineers' Council for Professional Development and its Committees on Student Selection and Guidance, Engineering Schools, Professional Training, and Professional Recognition. The accrediting of engineering curricula was resumed on a full-scale basis for the first time after World War II. Activities in the advising of high-school students about the possibilities of an engineering career were intensified. Testing programs for students entering the engineering schools were stabilized and a new portfolio of guidance literature was prepared and disseminated. As a means of clarifying the methods of recognizing attainment in engineering, ECPD adopted standard names and specifications for the various grades of membership in engineering societies. These new grades are being submitted to the member societies for consideration and action.

PUBLIC SERVICE

To keep abreast of and to accept leadership in national affairs wherein the engineering profession has a direct interest or where it might be helpful in formulating national policies, the

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[1] A body made up of the presidents, junior past-presidents, and secretaries of the following engineering societies: The American Society of Civil Engineers; the American Institute of Mining and Metallurgical Engineers; The American Society of Mechanical Engineers; the American Institute of Electrical Engineers; and the American Institute of Chemical Engineers.

EJC organized a National Engineers Committee consultative to Federal Authorities. This committee, organized late in the year, aided in the selection of personnel for the Economic Co-operative Administration.

EJC Panel on Science Research Legislation maintained close contact with the progress of National Science Foundation legislation until the bill passed by the Eightieth Congress was vetoed by President Truman.

To determine how engineers might contribute to cancer research, EJC appointed a Cancer Research Committee. This committee met with medical leaders in cancer research and developed tentative methods of approach which may be put to use by groups of engineers in any locality where cancer research is in progress.

EMPLOYER PRACTICES

In April, 1947, an EJC subcommittee headed by President E. G. Bailey issued a preliminary report on employer practice regarding engineering graduates. A supplemental report in November, 1947, included the analysis of replies from 125 co-operating employers with more than two million employees of which 38,000 were engineering employees. This supplementary report revealed the opportunities open to engineering graduates for advancement into executive positions in industry. It also revises the estimated need of engineers up to 1950 from 31 to 27 per cent over those employed in 1946 and presented some comparative analysis of the 1946 EJC Survey of the engineering profession, "The Engineering Profession in Transition."

ENGINEERING MAN POWER

The Society co-operated with the War Department in a survey of the utilization of mechanical engineers in the Armed Forces during World War II. Tabulation of the returns by the War Department indicated that an appreciable percentage of mechanical engineers were employed in nonengineering capacities. The preliminary report is currently being studied by an ASME Committee which is drafting recommendations to insure full utilization of available engineering man power in future emergencies.

Implications of the Universal Military Training Bill for technological personnel is now being studied by the EJC Selective Service Committee. This committee is composed of engineers with experience in the fields of teaching, wartime industries, and with service in the Armed Forces, and is well prepared to advise on proper utilization of engineers under the new Selective Service Act.

EDUCATION FOR CITIZENSHIP

The Society continued its work of encouraging the members to discharge more fully their duties as citizens. Many discussions were held at national and local meetings under the auspices of the Engineers Civic Responsibility Committee and a number of articles were published in MECHANICAL ENGINEERING.

NUCLEAR ENERGY

The Society continued its study of the beneficent application of nuclear energy. David E. Lilienthal, chairman of the U. S. Atomic Energy Commission, addressed the 1947 Annual Meeting and asked for the support of engineers in dispelling public confusion about the uses of nuclear energy. At each of the other national meetings, eminent physicists addressed luncheon meetings of the Society on some phase of the subject.

Work on the glossary of nuclear-energy terms was continued during the year. Section VI on Biophysics has been completed; other sections are nearing completion. A glossary review committee has been appointed composed of representatives from engineering and medical organizations, interested in all phases of nuclear energy.

II INTERNATIONAL ACTIVITIES

The Society carried on its time-honored policy of co-operation with engineers and engineering societies in other nations. This activity is directed by Society officers and committees and is carried on in co-operation with the EJC Committee on International Relations.

In September, 1948, at London, the Society was well represented at the Seventh International Congress for Applied Mechanics at which 800 were registered and 225 papers presented. Steps were taken to organize an International Union of Theoretical and Applied Mechanics. Opportunity has been given to ASME to take the lead in organizing American participation.

In co-operation with six other societies and two foreign societies the ASME began publication in January, 1948, of a new journal called *Applied Mechanics Reviews*. The journal makes available each month a critical review of world literature in applied mechanics for the use of research workers in this field. Edited by Lloyd H. Donnell of the Illinois Institute of Technology, the journal depends on an international staff of reviewers.

The Society maintained its membership on the U. S. National Commission to organize American participation in a World Engineering Conference. The WEC is organizing a World Engineering Congress to be held in Cairo, Egypt, in 1949.

A Pan-American Engineering Congress planned for Rio de Janeiro in 1949 was endorsed by the EJC and participation by American engineers is being encouraged. A survey of Latin-American engineering schools is being made by S. S. Steinberg under the auspices of the State Department and in conjunction with ECPD.

Last year the EJC was chosen as one of the member bodies of the U. S. Commission on the United Nations Educational, Scientific, and Cultural Organization (UNESCO). R. M. Gates, past-president ASME, was named to represent the EJC on this Commission, and attended the UNESCO meeting in Mexico City on Nov. 21, 1947, where he was impressed by the lack of information among world delegates of the organized engineering profession in the United States. Steps have been taken to provide such information.

Through its standardization activities, the Society contributed to the program of unification of screw-threads standards of the principal English-speaking countries, Great Britain, Canada, and United States. At the close of the year, there was optimism that a new American unified screw-thread standard would soon be approved and therein reconcile the differences between the British Whitworth and American National screw-thread forms. Unification agreements are also pending on other screw-thread forms, and are in preparation on cylindrical fits, gages and methods of gaging, and drafting-room practices.

Franco Martinuzzi, co-ordinator of gas-turbine research for the National Research Council of Italy, addressed many Sections as ASME 1948 lecturer on comparative European and U. S. methods of gas-turbine design and construction.

During the year the EJC collection of books for war-devastated libraries was terminated. In all, 86,512 items of engineering literature were received from American engineers and distributed overseas.

The Society continued to co-operate with the Engineering Institute of Canada under the agreement made in 1945. At a meeting of the EIC-ASME Joint Conference Committee, progress was made in developing a procedure for the appoint-

Applied Mechanics Reviews
TAPS
SPINDLE NOSES
Letter Symbols for Mechanics of Solid Bodies
Circular and Dovetailed Forming Tool Blanks
CAST-IRON FLANGES AND FLANGED FITTINGS FOR REFRIGERANT PIPING

ENGINEERING LITERATURE PUBLISHED BY THE ASME DURING 1947–1948

ment of EIC members on ASME technical committees. The number of representatives of each Society was increased from three to four.

One of the Freeman scholars from China completed his studies in the application of mechanical engineering to agriculture and returned to China. The second scholar will complete his work early in 1949.

The Calvin W. Rice Memorial Scholarship, established by the Woman's Auxiliary to aid overseas students, was awarded to Arn Normann of Norway who is studying at Cornell University.

At the end of the year, the Secretary was in London to represent ASME and EJC at a conference of representatives of engineering societies of Western Europe and U. S. A. The conference considered various questions concerned with the operation and policy of their societies and how, by developing more intimate collaboration and an exchange of facilities and information, they could more effectively accomplish the purposes for which they were founded. Preceding the meeting he met with engineering societies in Sweden and Denmark, and following it he met with engineering groups in Italy.

III SERVICE TO MEMBERS

PUBLICATIONS

An innovation in the general program of member service was the new publications plan approved by vote of the members in 1947 and introduced in January, 1948. This plan provides a new digest service in MECHANICAL ENGINEERING: increases the number of papers available in pamphlet form, furnished at a nominal cost to cover handling and mailing; discontinues free preprints at national meetings; and establishes Transactions and *Journal of Applied Mechanics* on a subscription basis. The plan will be reviewed early in 1949 by the Board on Technology.

The *Applied Mechanics Reviews*, an abstract journal of the world's literature, was instituted in January, 1948. The progress reported on the Metals Engineering Handbook indicates that publication in part may be achieved late in 1949. Advertising receipts from MECHANICAL ENGINEERING and from ASME Mechanical Catalog and Directory were slightly larger than in the previous year, the increase coming from increased rates, the number of pages remaining approximately the same.

MEETINGS

Twelve national meetings and Division conferences attracted an attendance of 6422 (See Table 1). For the first time in many years the Annual Meeting was not held in New York, N. Y. Inability to secure adequate accommodations for members was the principal reason for the change to Atlantic City, N. J. Although the total registration was smaller than at the 1946 Annual Meeting, percentage attendance at technical sessions and committee meetings was larger and the general impression was registered that those who attended gained from the intimate contact to a greater degree than at a New York meeting. A policy of holding the Annual Meeting at Atlantic City every fourth year was adopted.

Society national meetings were better publicized than ever before. Three times as much information of a general and technical nature about the Society appeared in the public press. This was due in part to support by program-making agencies of the rule for submitting papers 90 days in advance of meetings.

Seventy-one Sections held 607 meetings, a decrease of 38 under the previous year.

TABLE 1

Meetings	Number of sessions	Number of papers	Attendance
Petroleum Conference, Oct. 6–8, 1947. Houston, Texas	11	21	400
ASME-AIME Fuels Conference, Oct. 20–21, 1947. Cincinnati, Ohio	5	9	264
Annual Meeting, Dec. 1–5, 1947. Atlantic City, N. J.	74	205	3216
Textile Conference, Jan. 8, 1948. Boston, Mass.	2	5	65
Materials Handling Conference, Jan. 12–16, 1948. Cleveland, Ohio	3	4	*
Spring Meeting, March 1–5, 1948. New Orleans, La.	8	17	375
Oil and Gas Power Conference, May 20–23, 1948. St. Louis, Mo.	8	14	332
Semi-Annual Meeting, May 30–June 5, 1948. Milwaukee, Wis.	29	84	1039
Applied Mechanics Conference, June 17–19, 1948. Chicago, Ill.	6	24	220
Fall Meeting, Sept. 7–9, 1948. Portland, Ore.	10	31	186
Industrial Instruments and Regulators Conference. Sept. 13–17, 1948. Philadelphia, Pa.	2	4	200
Aviation Conference, Sept. 13–17, 1948. Dayton, Ohio	2	4	125
	160	422	6422

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* ASME attendance not segregated.

STUDENTS

Persons enrolled as student members number 15,025 as compared to 10,338 the previous year. Increase of student membership was reflected in an increased number of student-branch meetings and registration at the 11 regional student conferences which closed the 1947–1948 academic year. A student branch was installed at the U. S. Naval Academy Midshipman School, making the total 124. During the 1947–1948 academic year, 678 student-branch meetings were held.

JUNIORS

The Junior Committee, organized to develop policies and procedures through which junior-member participation in the Society could be stimulated, completed the first full year of its activity, holding eight meetings. In addition to a pamphlet, "It's Up to You," distributed to all junior members, and a Junior Forum published during the winter months in Mechanical Engineering, the committee's projects include preparation of a student-member pamphlet, a review of ECPD reading list, and an operational manual for junior groups.

PROFESSIONAL DIVISIONS

Divisional status was conferred on the Petroleum Committee of the Process Industries Division. The number of active professional divisions in the Society now stands at 20 with membership of each ranging from 360 to 5600.

RESEARCH

Substantial progress has been made since inauguration of a revitalized research program last year. Four new projects were developed by the Research Committee: The Effect of Pressure on Viscosity of Lubricants; Coefficients of Discharge of Eccentric and Segmental Orifices; and The Role of Aluminum in the Graphitization of Steel. These projects illustrate the Society's policy of serving as a catalyst in solving problems common to one or more industries.

CODES AND STANDARDS

Earlier in the report, mention was made of the progress during the year in the unification of screw-thread standards. This activity was carried out under the Sectional Committee on Screw Threads (B1) organized under the procedures of the American Standards Association. ASME is the administrative sponsor for this Committee and the major administrative burden fell to ASME members and staff.

While only three standards were issued, 75 others are in various stages of development, of which 27 are in the final stages of completion, and one is being printed.

The Unfired Pressure Vessel Code (Section VIII) was completely revised and is now being reviewed for final approval. Important changes were authorized to bring the Code in line with current practice.

Work on a safety code for industrial power trucks was organized by the Safety Committee under the ASA procedure. Revisions of other Safety Codes are under way.

The Power Test Codes Committee continued its review of the present status of Power Test Codes. Two new PTC Committees were organized, one on Atmospheric Water-Cooling Equipment and the other on Steam-Jet Compressors.

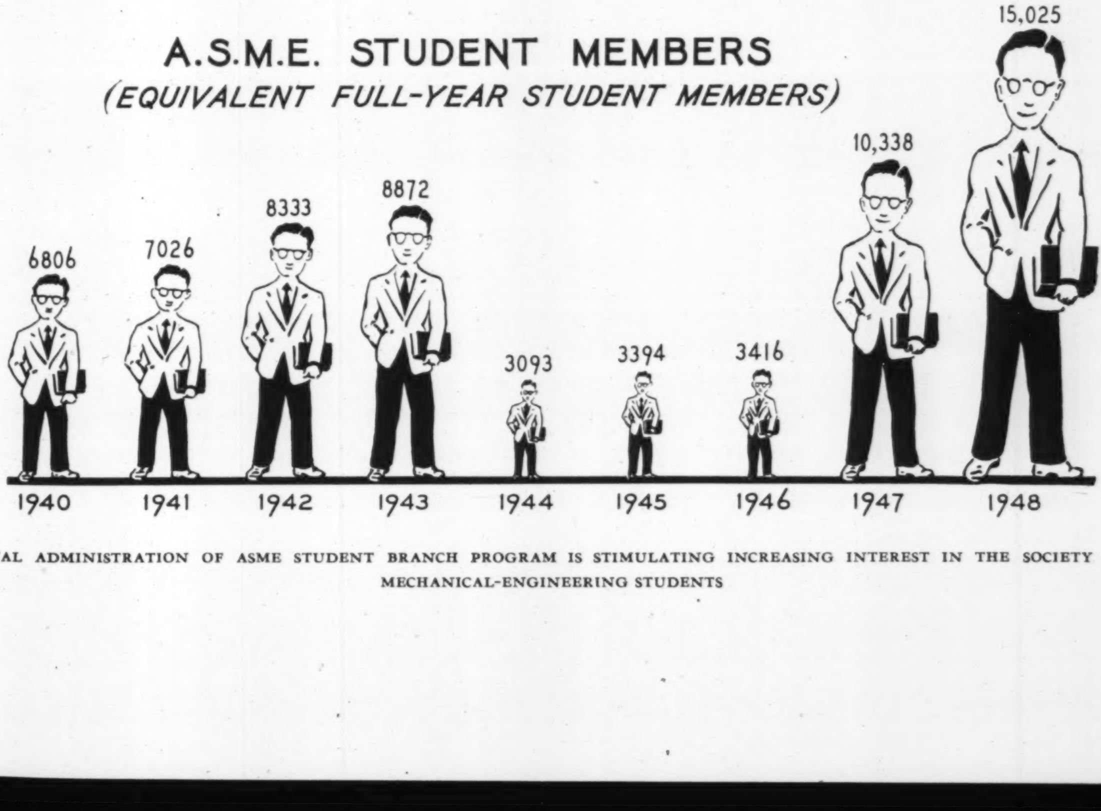
LIBRARY

The Engineering Societies Library served 23,500 callers and 17,000 requests by mail or telephone. This is a 25 per cent increase over services rendered two years ago. Five-thousand books and pamphlets were added to the collection. Income from services amounts to 25 per cent of total library income as compared to 15 per cent in previous years. The overcrowding of the library shelves and the increased activity of the Library have created a serious problem which at the end of the year was being attacked by the Library Board with the support of the United Engineering Trustees and with a grant of funds provided by The Engineering Foundation.

IV ADMINISTRATION AND ORGANIZATION

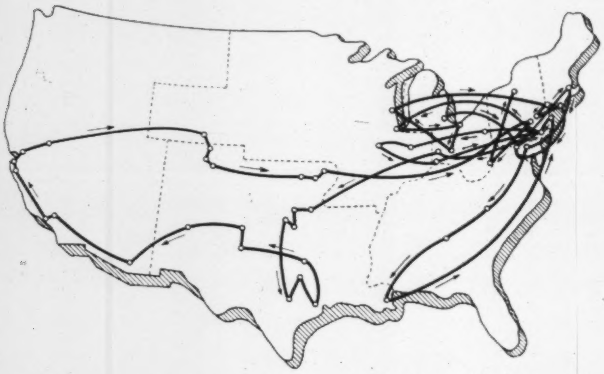
REGIONAL ORGANIZATION

This is the third year of operation of the plan under which the Vice-President selected by each Region exercises responsibility for work of the Sections and branches in his Region. The plan was reviewed by the Regional Administrative Committee and received a vote of confidence from the Regional Delegates, who reported that the plan was working better than the former system because Regional officers better understood the needs peculiar to their Region and because the new plan provided better representation of the members of the Regions in the national affairs of the Society. The eight Regional Administrative Committees met during the spring with constructive results, and the representatives of these Committees met at Milwaukee in the Regional Delegates Conference where the most important item of business was the problem of organizing the profession as reported under "National and Professional Accomplishments."



REGIONAL ADMINISTRATION OF ASME STUDENT BRANCH PROGRAM IS STIMULATING INCREASING INTEREST IN THE SOCIETY AMONG MECHANICAL-ENGINEERING STUDENTS

PRESIDENT E.G. BAILEY'S 1947-1948 ITINERARY



DURING THE YEAR PRESIDENT E. G. BAILEY VISITED 26 STUDENT BRANCHES AND 24 SECTIONS AT WHICH REPRESENTATIVES FROM 33 STUDENT BRANCHES WERE PRESENT, IN ADDITION TO 12 OTHER NATIONAL CONFERENCES AND SPECIAL MEETINGS

ORGANIZATION COMMITTEE

The Organization Committee continued its work of scrutinizing names proposed for committee service. This year the names numbered approximately 250.

A review of Society organization and operation was made during the year.

CONSTITUTION AND BY-LAWS

By letter ballot in the fall of 1947, the members approved a change in the constitution which limited the Fellow grade to those who had been members for thirteen years, and opened the way for changes in the By-Laws and Rules that remove the requirement that candidates for the Fellow grade must make an application for that transfer.

MEMBERSHIP

The membership of the society reached 26,576 at the end of the year, a new high (see Table 2). Part of this increase was due to the return to the prewar volume of transfers from the Student Member to Junior Member.

The Board on Membership expressed itself in favor of standard names and requirements for grades of members in engineering societies and has kept itself informed of ECPD actions on this matter. The Board is also studying simplification of the election and transfer procedures to shorten the process.

THE COUNCIL

The Council met twice, at Atlantic City, N. J., December, 1947, and Milwaukee, Wis., May, 1948. The Vice-Presidents met three times: Atlantic City, N. J., Dec., 1947, New Orleans, La., March, 1948, and Milwaukee, Wis., May, 1948. The Executive Committee of the Council met eight times.

The President visited twenty-six Student Branches and twenty-four Sections at which representatives from thirty-three Student Branches were present.

WOMAN'S AUXILIARY

The Woman's Auxiliary with a membership of 464, an increase of 18 per cent during the year, has six active local sections: New York, Chicago, Cleveland, Los Angeles, Philadelphia, and Milwaukee; the last one, organized during the past year, did splendid service at the Semi-Annual Meeting.

DEATHS

Among the members who died during the year there were four Honorary Members: Orville Wright; William S. Knudsen; Sir Leonard Pearce; and Roy V. Wright, who also served as President of the Society in 1931; others were: Past-President James H. Herron and A. J. Dickie, former member of the Council; George L. Knight, member of the Finance and Pension Committees; George F. Bateman, chairman of the Library Committee; Wallace Clark, chairman of the Organization Committee; and William D. Ennis, who had served the Society as Treasurer from 1935 to 1944.

SECRETARY'S OFFICE

Clifford B. LePage, Assistant Secretary, for 28 years and a member of the Society, died Jan. 15, 1948; and Mabel Smith, receptionist and a member of the staff for 29 years, died June 15, 1948. Stanley A. Tucker was added to the staff in April as Standards Manager. Robert A. O'Brien was given the designation of Research Manager, and O. B. Schier, 2nd, was designated Meetings Manager. Walter Letroadec resigned as Personnel Administrator and Harry E. Edwards replaced him.

V FINANCES[2]

The income of the Society for the year exceeded a million dollars, the largest income in the history of the Society. The policy of the Council was to use the income of the Society for service to the members. A net income over expense of $949.37 is reported. This amount plus initiation and transfer fees amounting to $20,780, make a total addition to surplus for the year of $21,729.37.

TABLE 2 CHANGES IN MEMBERSHIP

(Sept. 30, 1947, to Sept. 30, 1948)

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1948	Sept. 30, 1947	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net change
Honorary members	47	46	3	2					4	5	4	+ 1
Fellows	262	229	44	1		2			10	45	12	+ 33
Members	11370	10944	233	483	120	45	113	112	140	836	410	+ 426
Associates	370	359	3	30	6	4	7	9	8	39	28	+ 11
Junior (20)	3161	2710	653	113	56	173	63	128	7	822	371	+ 451
Junior (15)	2791	2304	1180	139	26	707	62	88	1	1345	858	+ 487
Junior (10)	8575	6803		3205	55	1185	113	183	7	3260	1488	+1772
Total membership	26576	23395	2116	3973	263	2116	358	520	177	6352	3171	+3181

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[2] The certified report of the auditors, Price, Waterhouse & Co., is on file in the Society office and available for inspection by the members.

The Balance Sheet of Sept. 30, 1948, shows, on that date, that the Society owed:

(1)	Current bills and federal tax withheld from employees	$ 7,589.89
(2)	Obligations for printing and distributing the 1949 Mechanical Catalog and other bills which have not been submitted	25,862.98
(3)	Unexpended appropriations for future services	85,884.28
(4)	Special research and other committees which have collected funds for special purposes to be expended as needed	89,714.87
(5)	Future services to members who have prepaid dues	129,642.20
(6)	Subscribers to publications who have prepaid	4,000.00
		$342,694.22

To meet these debts the Society had:

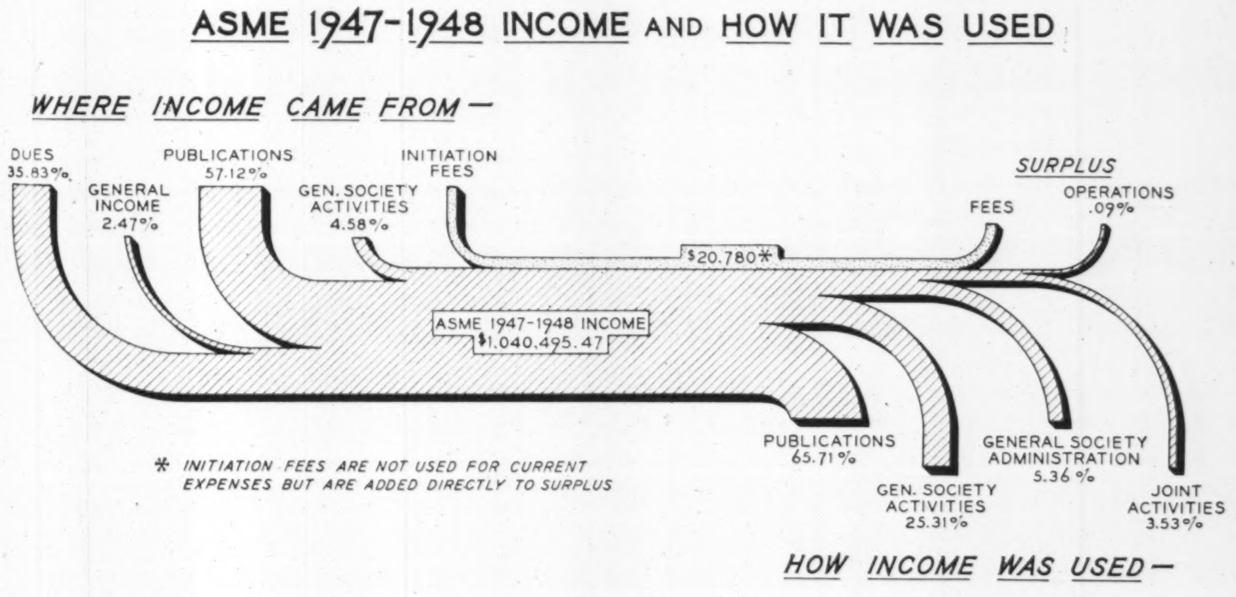
(1)	Cash in the bank	$ 45,384.38
(2)	Accounts receivable	131,561.25
(3)	Inventories of publications and supplies conservatively valued at	62,856.66
(4)	Securities (at the lower of cost or approximate quoted marked values)	687,362.50
		$927,164.79

The difference between the value held by the Society of $927,164.79 and debts of $342,694.22, is the net worth of the Society on Sept. 30, 1948, $584,470.57, of which $500,000.00 has been set aside as a General Reserve against Contingencies, leaving a balance of	$ 84,470.57

The Society had other liabilities:

(1)	Development Fund of		$108,483.90
	Against which it had		
	(a) Cash	$ 15,921.40	
	(b) Securities (at the lower of cost or approximate quoted market values)	87,562.50	
	(c) Notes receivable	5,000.00	
		$108,483.90	
(2)	Employees' Retirement Fund of		$105,973.68
	Against which it had		
	(a) Cash	$ 4,915.10	
	(b) Securities (at the lower of cost or approximate quoted market values)	101,058.58	
		$105,973.68	
(3)	Trust Funds amounting to		$154,481.99
	Against which the Society had the following assets:		
	(a) Cash	$ 9,963.98	
	(b) Securities (at the lower of cost or approximate quoted market values)	144,518.01	
		$154,481.99	
(4)	Property Fund of		$551,406.29
	With the following assets to support it:		
	(a) Quarter interest in building	$498,448.48	
	(b) Office furniture and fixtures (depreciated value)	52,955.81	
	(c) Library books	1.00	
	(d) Engineering Index, Inc.—Title and good will	1.00	
		$551,406.29	

Table 3 shows the income and expense for the major groupings of Society activities. Table 4 shows the activities which produce an income and those which result in a net expense.


ASME 1947-1948 INCOME AND HOW IT WAS USED
WHERE INCOME CAME FROM—
DUES 35.83%
GENERAL INCOME 2.47%
PUBLICATIONS 57.12%
GEN. SOCIETY ACTIVITIES 4.58%
INITIATION FEES
SURPLUS
FEES
OPERATIONS .09%
$20.780*
ASME 1947-1948 INCOME $1.040.495.47
PUBLICATIONS 65.71%
GEN. SOCIETY ACTIVITIES 25.31%
GENERAL SOCIETY ADMINISTRATION 5.36%
JOINT ACTIVITIES 3.53%
* INITIATION FEES ARE NOT USED FOR CURRENT EXPENSES BUT ARE ADDED DIRECTLY TO SURPLUS
HOW INCOME WAS USED—

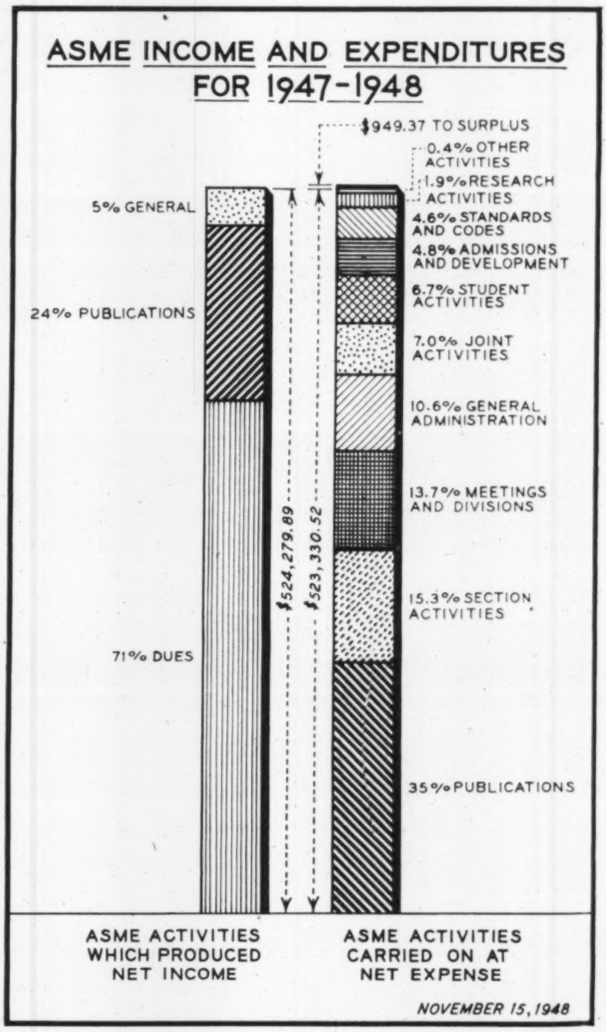
THIS SKETCH SHOWS THAT DUES PAID BY MEMBERS COMPOSES APPROXIMATELY ONE-THIRD OF THE SOCIETY'S GROSS INCOME

TABLE 3 INCOME AND EXPENSE FOR MAJOR GROUPS OF SOCIETY ACTIVITIES

	Expense	Income		Net	Expense per member	Income per member	Net Expense per member
Dues	......	$ 372,839.99	+	$372,839.99	...	$14.03	...
General Income (interest, discount, emblem sales, Engineering Index)	......	25,713.69	+	25,713.69	...	0.97	...
						$15.00	
Publication, Standards, Codes, and Research	$ 683,686.27	$ 594,360.79	—	89,325.48	$25.72	22.36	$ 3.36
General Society Activities (meetings, sections, student branches, admissions, etc.)	263,363.84	47,581.00	—	215,782.84	9.91	1.79	8.12
General Society Administration (council, auditor, counsel, retirement fund)	55,765.82	....	—	55,765.82	2.10	...	2.10
Joint Activities (Library, ECPD, EJC, etc.)	36,730.17	....	—	36,730.17	1.38	...	1.38
Addition to surplus from operating income	949.37	....	—	949.37	.04	...	.04
Total	$1,040,495.47	$1,040,495.47			$39.15	$39.15	$15.00
Addition to surplus from initiation fees		20,780.00					0.78
Total addition to surplus		21,729.37					0.82

TABLE 4 INCOME AND EXPENSE OF ASME ACTIVITIES, 1947–1948

Activities Which Produce a Net Income		
MECHANICAL ENGINEERING and Mechanical Catalogue income	$412,496.05	
Less production costs, wages, and indirect	299,685.51	$112,810.54
General publication sales income	$ 79,936.18	
Less stock cost, wages, and indirect	67,020.51	12,915.67
Engineering Index		2,515.06
Miscellaneous sales		4,534.89
Interest and discount		18,663.74
Membership dues		372,839.99
Total		$524,279.89
Activities Carried on at a Net Expense		
MECHANICAL ENGINEERING text (production, wages, and indirect)		$101,737.02
Transactions (production, wages, and indirect)		74,330.66
Membership List (production, wages, and indirect)		5,089.08
Standards and Codes income	$ 98,658.28	
Stock cost, wages, and indirect	122,699.73	24,041.45
Research income	$ 3,270.28	
Stock cost, wages, and indirect	13,123.76	9,853.48
Student dues	$ 44,938.00	
Student expense (production, wages, and indirect)	80,312.20	35,374.20
Meetings income	$ 2,643.00	
Costs, wages, and indirect	50,291.59	47,648.59
Sections (appropriations, travel, wages, and indirect)		80,811.37
Divisions (appropriations, wages, and indirect)		24,485.93
Admissions and development (wages and indirect)		25,518.12
Awards (costs, wages, and indirect)		1,582.60
Engineers' Civic Responsibility		362.03
oint Activities		36,730.17
General administration		55,765.82
Total		$523,330.52
Net income		$ 949.37



THIS SKETCH SHOWS THE ASME ACTIVITIES WHICH WERE CARRIED ON AT NET INCOME OR NET EXPENSE

1948 ASME ANNUAL MEETING

Wide Range of Subjects Discussed in New York, November 29 to December 3, at Hotel Pennsylvania

WITH an attendance in excess of 5000 the 1948 Annual Meeting of The American Society of Mechanical Engineers got under way on Monday, November 29 and ran through Friday, December 3, taxing the convention facilities of the Hotel Pennsylvania, New York, N. Y., with technical sessions and committee meetings. By the time a thorough check is made of attendance at individual sessions it will probably be revealed that this was the largest meeting ever held by the Society. Consistently throughout the week registration figures were several hundred in excess of figures reported on corresponding days of the 1946 meeting, the last one held in New York before this year. About 200 papers were delivered at 70 sessions and at numerous luncheons and dinners. The Annual Dinner and Honors Night, held on Wednesday, also had a record attendance. Throughout the week industrial movies were being displayed for the persons whose minds were weary with listening to engineering discussions and whose feet were too tired to stand around in lobbies talking with friends. The Woman's Auxiliary did its usual fine job of entertaining the wives of visiting engineers, and several other societies, notably the American Rocket Society and the American Association for the Advancement of Science, co-operated in the program. Under the auspices of the Engineers Civic Responsibility Committee two ASME members, William L. Batt and Leonard J. Fletcher, took part in the Town Meeting of the Air broadcast, which was televized on Tuesday night. A photographic exhibit offered an opportunity for members to display examples of their work. Concurrently the 18th National Power Show was in progress at the Grand Central Palace. It was a busy and an eventful week.

In the pages that follow an attempt is made to cover the high lights of the program, with the exception of the technical sessions, which, in general, are covered by the abstracts published from month to month in this magazine as they become available.

PROFESSIONAL DIVISIONS DISCUSS A BETTER SOCIETY AT 1948 ANNUAL MEETING

On Sunday evening, November 28, 1948, before 150 officers and members, whom President E. G. Bailey called the "strong backbone" of the Society, spokesmen for the Board on Honors and Awards, Board on Technology, and the standing committees on Research, Meetings, Publications, and Professional Divisions, described how the functions of these Society agencies could be co-ordinated and give improved service to the membership and the engineering profession.

Sponsored by the Professional Divisions Committee for the express purpose of discussing the topic "Better Professional Divisions for a Better Society," the meeting attracted a responsive audience. As the role of the twenty professional divisions was called, a friendly competition developed, with the Management, Gas Turbine Power, and the Oil and Gas Power Divisions taking the honors for having the largest number of their executive committee members present.

In the audience also were President Bailey, President-Elect James M. Todd, five past-presidents, eight regional vice-presidents, two regional vice-presidents-elect, and seven of the directors at large. As W. L. H. Doyle, chairman of the Professional Divisions Committee, introduced the officers of the professional divisions, it became apparent that here was a meeting before which the entire gamut of Society activities could be reviewed with constructive results.

With introductions over, President Bailey started the formal portion of the program by characterizing the meeting as the best in his memory. He emphasized two points in the introductory statement: (1) the need for each professional division to appoint a research secretary who could find the time to contribute to the work of the Society's research program, a Society activity which, although of great importance to the engineering profession, was being neglected by the Professional Divisions; and (2) the need for tailoring Section meetings to serve the requirements of the young engineer seeking his place in the profession.

Mr. Doyle introduced the following members who presented prepared statements: President-Elect James M. Todd, chairman, Board on Honors and Awards; C. B. Peck, chairman, Board on Technology; G. A. Hawkins, chairman, Research Committee; P. W. Thompson, chairman, Meetings Committee; and H. L. Dryden, chairman, Publications Committee. Mr. Doyle concluded the formal portion of the program by presenting a statement in his capacity as chairman of the Professional Divisions Committee.

President-Elect Todd, speaking for the Board on Honors and Awards, urged that the Society's honors and awards be conferred on distinguished members of the profession during their professional careers when such recognition would give prestige to the recipients. Such a policy would encourage engineers to support technical Society activity and benefit the engineering profession. The Board, he said, needs the aid of Professional Divisions in seeking out the engineers who deserve professional acclaim.

Mr. Peck, speaking for the Board on Technology, described the organization of the Board and listed its main functions as: (1) Co-ordination of the technical life of the Society; (2) approval of recommendations of the four ASME standing committees, Research, Meetings, Publications, and Professional Divisions; (3) formulation of policies; and (4) initiation of projects to insure development and adequate coverage in the various fields of mechanical engineering. To handle adequately the fourth function, the Board was to increase its members at large from two to four, and their length of service from two to four years.

The importance of "background research," according to Professor Hawkins who spoke for the Research Committee, lay in its role as industrial insurance for tomorrow. The two main objectives of his Committee he listed as: (1) encouraging and directing background research to extend the boundaries of knowledge in mechanical engineering; and (2) encouraging engineers to train themselves for assuming responsibility for research. Until now the Committee has limited its activities to the first objective, but the time has come for it to work closely with other Society groups to bring out research talent of mechanical engineers.

Mr. Thompson, speaking for the Meetings Committee, touched on some of the problems involved in providing quality rather than quantity in all phases of Society meetings. He

E. G. Bailey

Retiring President of
The American Society
of
Mechanical Engineers
for 1948

stressed the importance of good discussion, which, he said, depended on early submission of papers by authors, distribution of preprints, and solicitation of comments well in advance of meetings. He expressed satisfaction over the growing success of the routine of processing papers. On the other hand, this Committee was concerned over the $5 nonmember registration fee which was the cause of many complaints from members who invite guests.

Mr. Dryden of the Publications Committee called the creative technical work of ASME members the foundation of the Society, and the function of the Society's publications, to enhance the value of this work by disseminating it to interested engineers. So long as creative work is locked in the mind of its creator, or in his files, it contributes nothing to technical progress, he said. Meetings give opportunity for presentation of the work of a relatively few members to a small fraction of the engineering profession. Publications, however, by extending the availability of such presentations, by reporting and interpreting creative work, serve to advance technical progress.

Mr. Doyle, speaking for the Professional Divisions Committee, called attention to the Society's 20 Professional divisions as the primary agencies for motivating the flow of technical information among its members. Referring to the overload on Society publications facilities, he said that it was quality of papers contributed rather than the number of sessions sponsored, which was the proper basis on which to weigh the relative usefulness of a professional division.

With the growth of the Society, the administrative load now carried on by volunteers in the professional divisions is becoming more and more difficult to carry. If the divisions are to operate successfully for benefit of the membership, it will be necessary to increase Headquarters staff serving them.

Upon conclusion of his statement, Mr. Doyle received a Certificate of Award from President Bailey in recognition of five years of service on the Professional Divisions Committee.

For the next 45 minutes a lively discussion from the floor touched on many aspects of Society activity. Concern was expressed for the young engineer and suggestions were offered to improve the Society's service to him. Some of the professional divisions, already carrying a heavy administrative load

James M. Todd

President of
The American Society
of
Mechanical Engineers
for 1949

and seeing no respite in the Society's growing activities, emphasized again the need of some kind of financial or staff assistance in the conduct of their affairs. Professional assistance to sections in matters of publicity and the need to humanize leaders of the profession so that their achievements would serve as inspiration for students, were mentioned.

W. M. Murray, speaking for the Applied Mechanics Division, suggested that members would benefit more from the Society if closer contact could be maintained between members and the executive committees of the professional divisions in which they are enrolled. In his division, he said, liaison could be improved by employment of a permanent secretary. While this seemed impractical, a step in the right direction would be appointment of a secretary for a five-year period. In producing the *Journal of Applied Mechanics*, Professor Murray said, his division processes more than 100 papers annually. This task imposes a heavy burden on its officers who must furnish their own secretarial assistance. It also deprives younger men without access to free secretarial service of the opportunity of division leadership.

Later in the evening this problem was again introduced by Martin Goland, chairman of the Applied Mechanics Division. The problem of staff assistance for the professional divisions, he warned, must be faced by the Society.

The importance of stimulating student interest in the Society by assigning specific responsibilities to the student branches was mentioned by Victor Wickum of the Process Industries Division. Equally deserving of Society attention was the problem of keeping junior members active in the sections, according to President Bailey.

W. Julian King, of Cornell University, told of a problem encountered by him in advising graduating engineers to seek out and work with the "masters" of their profession. The advice was good, he thought, but students failed to recognize those engineers who could properly be called masters of mechanical engineering. Engineering societies could help, he said, by giving some attention to the human factors of engineering, specifically by dramatizing the personal achievements of the active engineers.

H. B. Maynard, of the Management Division, told of the hardships faced by managers in democratic countries overseas because of the conflict of world ideologies. He appealed to American engineers to support the American Management Council and to orient themselves in the international world in which all must live.

T. R. Olive, editor, *Chemical and Metallurgical Engineering*, concluded the meeting with a summary of the discussions, following which a standing vote of thanks was given to Mr. Doyle and his committee for their initiative in planning so fruitful a meeting.

THE ASME COUNCIL MEETS

Every member of the 1948 ASME Council was present at the opening session of its closing meeting on Sunday, November 28, at the Hotel Pennsylvania. President E. G. Bailey presided. In addition there were present all but two of the newly elected members of the Council. President-Elect James M. Todd was delayed by flood conditions in Alabama and arrived in time for the Sunday evening "Better Society Conference" held under the auspices of the Professional Divisions Committee; and J. A. Keeth, of Kansas City, wrote that a rigorous schedule of diet and treatments made the trip to New York an impossibility.

ANNUAL REPORTS APPROVED

Copies of the Annual Report of the Council and Reports of the Boards and Committees to the Council, including the finance report, were adopted and accepted by the Council. The report of the Council will be found on pages 51–58 of this issue. Reports of Boards and Committees, separately printed, are available at the Secretary's office and copies may be obtained on request.

The report of the Woman's Auxiliary, which noted the 25th anniversary of the Auxiliary, was accepted by the Council with expressions of sincere appreciation.

There were expressions of sentiment among members of the Council that an effort should be made to provide items of interest to women in the technical programs of the Society, and the question was referred to the Meetings Committee for study and report to the Council.

In recognition of the 25th anniversary of the Woman's Auxiliary a history of its development and activities had been prepared and was in process of publication. Request was made by the Auxiliary for an appropriation to cover the expense of this publication. This request was referred to the Finance Committee for favorable consideration.

MEMBERS OVERSEAS

Exchange difficulties and changes in ASME publication procedure which require members to subscribe to the Transactions and *Journal of Applied Mechanics* brought forth in the spring of 1948 about eight requests from members overseas for a review of their plight and concessions to alleviate it. The Council considered the question at its meeting in Milwaukee and asked to have it explored. A recommendation by the Board on Technology was discussed at the October 22 meeting of the Executive Committee of the Council and was not accepted. Instead, a special committee consisting of K. W. Jappe, chairman, A. R. Mumford, and C. E. Davies, was asked to make a study of broader considerations involved in the relationship of members overseas to the Society and to report recommendations. A detailed report was prepared on the basis of a thorough examination of numerous factors, including difficulties of exchange and change of publication procedure. The report, which was read by Mr. Jappe and amplified by his comments, recommended "that the Society adhere to its established policy regarding dues to foreign members as originally adopted on Nov. 25, 1945, without further concessions of any kind. This recommendation was adopted by the Council and the Committee was discharged with expression of the thanks of the Council for its work.

BY-LAW CHANGES

Changes in the By-Laws relating to Article B6A, paragraphs 2, 12, and 15, Boards and Committees, were adopted. Paragraph 2 has been reworded by the changes adopted to tie specifically to the By-Laws the delegation of the authority of the Council to the Boards. Paragraph 12 concerns merely a change from a former to the current official name of the Constitution and By-Laws Committee. Paragraph 15 adds two more members at large to the Board on Technology and increases the terms of office of these members from two to four years in order to make the work of the Board, up to now hampered by lack of continuity of membership, more effective. Adoption was also voted of minor changes of wording or numbering of By-Laws B9, Pars. 1, 2, and 3; B13, Par. 1; and B16, Par. 3, 4, and 5.

BY-LAWS PRESENTED FOR FIRST READING

As chairman of the Constitution and By-Laws Committee, F. W. Miller presented for first reading suggested changes to Article B6A, Par. 18b relating to the personnel and term of office of the Membership Development Committee, to Article B6B, Par. 4, relating to the ASME representation on the Library Board of the United Engineering Trustees, Inc., and the deletion of Par. 14 of B6A, relating to the ASME Library Committee made unnecessary by recent streamlining of the Board by UET.

Change in Rule 10, adopted by the Council, will make the rule conform to current practice in the balloting on applications for admission.

SIXTY-FIVE-YEAR MEMBERS

Certificates recognizing 65 and more years of membership in the Society were authorized for presentation to Henry Marx, W. F. Durand, and Jay M. Whitham.

PUBLIC RELATIONS

W. M. Sheehan, member of a newly constituted Public Relations Committee, asked for views of Council members on the objectives of the Committee. A lively discussion ensued.

ASME HEADQUARTERS STAFF

In conformity with a practice initiated several years ago of recognizing and expressing appreciation of the services of headquarters staff members employed by the Society for 25 years or more, the Secretary presented to the Council on Monday morning, Frederick Lask, advertising manager (35 years) and A. W. Schrage and Marguerite Marty, of the advertising department (30 years). On motion the Council extended their deep appreciation of the services of these members of the staff and the President gave each a check. The Secretary then presented two new members of the staff, Stanley A. Tucker, standards manager, and Harry W. Edwards, personnel administrator.

BOARD ON TECHNOLOGY

C. B. Peck referred to the annual report of the Board on Technology, of which he is chairman, and stressed the attempts being made by the Board to separate its planning and policy functions from its routine administrative functions. This was being done, he said, by carrying on the routine administrative duties at regular meetings held during the day and by holding evening sessions, preceded by a dinner, to consider problems relating to the health of the technical life

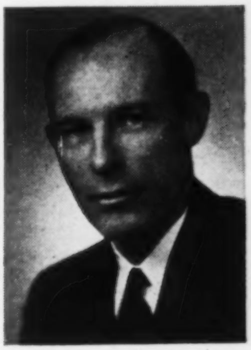
New Members of the 1949 ASME Council

Regional Vice-Presidents

A. R. MUMFORD

ARTHUR ROBERTS, JR.

FORREST NAGLER



CARL J. ECKHARDT

Directors at Large

J. A. KEETH

RALPH A. SHERMAN

of the Society. Two such dinner meetings had been held in the fall of 1948 at which the problem of broadening the base of selection of committeemen had been discussed. The President of the Society had been present at both dinner meetings, Mr. Peck reported. It was the intention, he pointed out, to hold more of these meetings in the spring to which specialists in the subjects to be discussed would be invited. The second project, he announced, would be to take a look at the entire technical program of the Society to determine if it were being handled properly and adequately. It was quite possible, he declared, that this investigation might disclose the need for new or expanded activity. He assured the Council that the Board was taking its administrative and planning duties seriously, but he could not predict what the results would be.

BOARD ON CODES AND STANDARDS

Howard Coonley, chairman of the Board on Codes and Standards, reported on three significant accomplishments of the year in screw threads, a plumbing code, and revised rules for the construction of unfired pressure vessels. Mr. Coonley reviewed briefly the origin and progress of an attempt, initiated during the war, to secure agreement of the United States, Canada, and the United Kingdom on screw threads. Many missions and much work had been involved, he said, but on Nov. 18, 1948, the standard was consummated and had become the first great industrial treaty. The new plumbing code, he reported, greatly simplified previous codes, while the revision of the code for unfired pressure vessels replaced two former codes. There were 25 projects under consideration by the Board, he reported, and great accomplishments would be effected during the coming years.

Mr. Coonley spoke briefly on international standardization in which the United States and ASME were taking an active part. Since ASME had been a pioneer in industrial standardization and was today the most powerful member of the American Standards Association, it was his hope that the ASME Council and members would recognize the importance of standardization as a contribution to world peace.

In the discussion that followed it was made clear that manufacturers in the United States were faced with a responsibility to make sure that the new screw-thread standards were put into use as quickly as possible.

OTHER BOARDS AND COMMITTEES

K. H. Condit, chairman, Organization Committee, had no report beyond that in the annual report of the Committee.

OUTSTANDING ENGINEERS

(Notables in the field of engineering who attended the 69th Annual Meeting of The American Society of Mechanical Engineers in New York included many former heads of the organization. Shown *left to right*, are: James M. Todd of New Orleans, who was installed as President for 1949 during the meeting; E. G. Bailey of New York, his predecessor; and Past-Presidents Dr. D. Robert Yarnall of Philadelphia; Robert M. Gates of New York; James W. Parker of Detroit, and Dr. David S. Jacobus of Montclair, N. J.)

For the Board on Membership, T. H. Wickenden, chairman, asked for an expression of views of members of the Council on possible changes in Society policy on dues-exempt members. There was considerable discussion, after which Mr. Bailey asked the Board to take all the factors mentioned into consideration, make a thorough study, and to report to the Council within six months.

ENGINEERS JOINT COUNCIL

The Secretary reviewed the steps leading up to the recent adoption of a constitution for the Engineers Joint Council and gave a résumé of the changes incorporated in it which made it a more effective instrument than the by-laws under which EJC has been operating.

He reviewed also progress in efforts to unify the engineering profession that had been made at the 1948 Semi-Annual Meeting and since that time.

He reported on the conference in London which he and W. N. Carey, secretary ASCE, had attended during the fall at the invitation of The Institution of Civil Engineers, The Institution of Mechanical Engineers, and The Institution of Electrical Engineers. Colonel Carey, who was present at the Council Meeting, also spoke on the London conference, and L. Austin Wright, secretary, Engineering Institute of Canada, also present, explained that because EIC had participated in a Commonwealth conference in 1947, and in order not to overbalance the 1948 conference with Commonwealth representatives, EIC had not been represented at the 1948 Conference. For further report of the London conference see the News Section of this issue.

Linn Helander, vice-president ASME, presented a "plan for employing EJC and ECPD as constituents of a bicameral unifying council for engineers." Professor Helander's plan was referred to ASME representatives on EJC and ECPD for study and report.

1948 ANNUAL BUSINESS MEETING

The 1948 Annual Business Meeting of The American Society of Mechanical Engineers was called to order by President E. G. Bailey at the Hotel Pennsylvania at 5 p.m., Monday, Nov. 29, 1948. The Secretary presented the report of the Council (see pages 51–58 of this issue), the reports of Boards and Committees to the Council, and the Finance report and emphasized the high lights of their contents. He also presented for the record a list of the assets of the Society and their location, a list of members elected during the year, and a list of members whose deaths had occurred during the year. On motion the reports and the actions of the Council for the year were approved.

The Secretary presented the report of the tellers of the election of officers for the year, as follows: James M. Todd, president; A. R. Mumford, Arthur Roberts, Jr., Forrest Nagler, and Carl J. Eckhardt, vice-presidents; and J. A. Keeth and R. A. Sherman, directors at large. Mr. Bailey declared these officers elected and introduced each, with the exception of Mr. Keeth who was unable to be present.

The Secretary also presented the report of the tellers of letter ballots on amendments to the Constitution, all of which had been favorably voted on, relating to the Fellow grade, the succession of vice-presidents, place of meeting of the Delegates Conference, and the Canons of Ethics. Mr. Bailey declared the amendments to be in effect.

Resolutions commending the Secretary and his staff and officers of the Society were presented and passed.

C. E. Davies, secretary, and George A. Stetson, editor, who had been notified by the President at the Council Meeting of their promotion to the grade of Fellow, were introduced and expressed their appreciation of the honor conferred on them.

1400 ATTEND ANNUAL DINNER

Fourteen hundred members and guests attended the 69th Annual Dinner of The American Society of Mechanical Engineers held in the ballroom of Hotel Pennsylvania, Dec. 1, 1948, amid color and glamour which contrasted sharply with the concentration at the technical session held in the same room only a few hours earlier.

Before the towering emblem of the American eagle which covered the entire rear wall of the ballroom, members and guests witnessed the impressive ceremonies during which the Society conferred honors and awards on distinguished engineers, recognized the promise of several young men of the profession, and paid tribute to the leadership of its senior members and officers.

Before the evening was over the Society hailed its president-elect, James M. Todd, and heard its retiring president, E. G. Bailey, outline a promising future of the engineer whose service to American industry and the engineering profession may well lead the world toward a solution of its problems in human relations.

R. M. Gates, Fellow and past-president, ASME, and president, Air Preheater Corporation, New York, N. Y., was toastmaster. Seated with him on the dais were President E. G. Bailey, President-Elect James M. Todd, Air Commodore Sir Frank Whittle, 1946 Guggenheim Medalist and 1948 Kelvin Medalist, recipients of honors and awards, and honored guests.

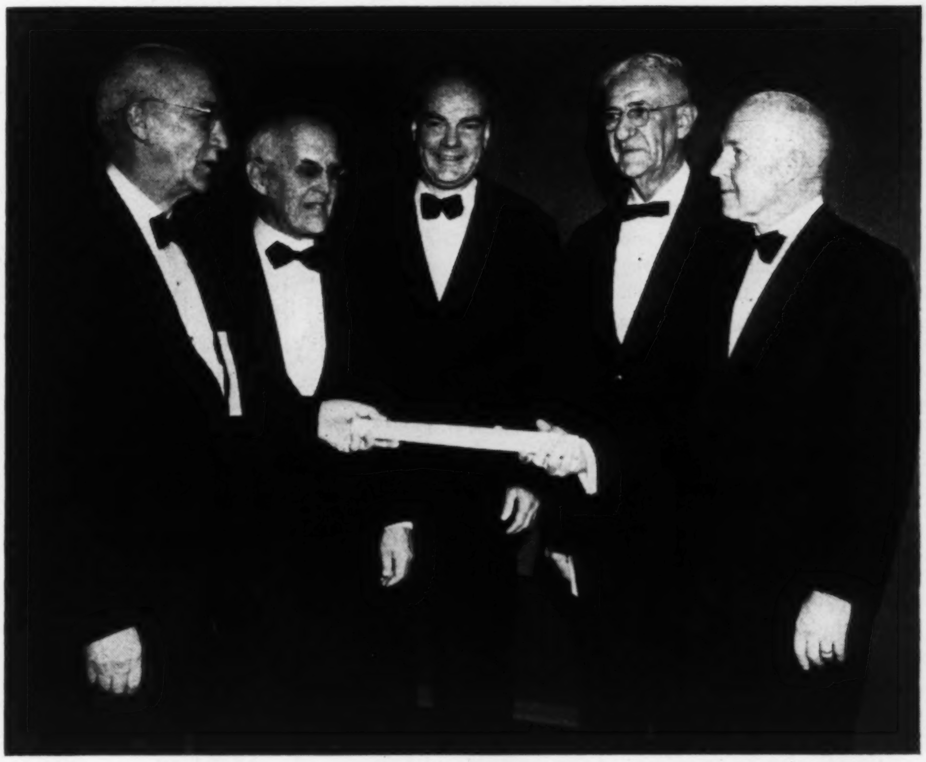
Mr. Gates extended a welcome to distinguished guests from foreign countries, and officers of the United Engineering Trustees, the Engineers Joint Council, and other sister societies, who were asked to rise and receive the applause of the audience.

On the occasion of the Annual Meeting the Society honors members who during the past year have completed 50 years of membership in the ASME. Mr. Gates asked George W. Bacon to come forward to receive the Fifty-Year Membership badge. Mr. Gates then read the names of 11 other members who have joined the Fifty-Year Members, but who were not present to receive their badges. They will receive their badges at appropriate ceremonies later in their own communities. Those members were: Robert E. Hall, Adalbert Harding, David T. Jones, George H. Merrill, Charles S. Mott, Dr. Fritz Neuhaus, Alexander M. Orr, William E. Reed, Harold A. Richmond, Alfred H. Stevens, and George F. Waddell. Expressing the regret of the Society, Mr. Gates announced that Dean E. E. Hitchcock, who was to have been honored, died recently.

HONORS AND AWARDS

Turning next to the presentation of honors and awards, Mr. Gates explained that the following student-member and junior awards would be presented at the Members and Students Luncheon on Thursday, Dec. 2.

Undergraduate Student Award to Leroy W. Ledgerwood, Jr., Student Mem. ASME (Oklahoma A&M College, '49), for his paper, "Hired Technicians or Professional Engineers."



HONORARY MEMBERS

(President E. G. Bailey with four of the five men upon whom honorary membership in The American Society of Mechanical Engineers was conferred during the Society's 69th Annual Meeting. *Left to right,* President Bailey, George I. Rockwood, James W. Parker, Oscar A. Leutwiler, and Carl F. Braun. Dr. Lyman J. Briggs is not shown.)

HUNT DAVIS RECEIVES JUNIOR AWARD

(President E. G. Bailey presents the Junior Award to Hunt Davis, *right:* Ely C. Hutchinson read the citation.)

Postgraduate Student Award to Thomas L. Dinsmore, Jun. ASME (University of Rochester, '46), for his paper, "An Experimental Investigation of the Stresses in Eyebars."

Charles T. Main Award to E. Duane Stewart, Student Mem. ASME (University of Pittsburgh, '48), for his paper, "The Relation of Invention to Engineering."

Mr. Gates then called on Ely C. Hutchinson, Fellow ASME, to read the citations of the other awards, and on Lewis F. Moody, Fellow ASME, and Clarke Freeman, Mem. ASME, members of the Board on Honors, to serve as marshals.

As the awards were announced, the marshals escorted the recipient to the center of the dais where the citations were read and each received from the President such certificates or medals as the award provided. The following awards were presented:

Junior Award to Hunt Davis, Jun. ASME, for his paper, "A Method of Correlating Axial-Flow-Compressor Cascade Data."

Pi Tau Sigma Medal to Walter G. Vincenti "for outstanding achievement in mechanical engineering." William C. Parrish of General Electric Company, Schenectady, N. Y., was awarded honorable mention for this award.

Melville Medal to Reginald E. Gillmor, Mem. ASME, for his paper, "The World-the Manager Lives In."

Warner Medal to Edward S. Cole, Fellow ASME, "For contributions to the measurement of flow of water in conduits and the speed of ships, based on original applications of the Pitot tube and the development of the Cole pitometer."

Holley Medal to Edwin H. Land, "Scientist, inventor, engineer, for his great and unique work in polarized light and optics."

REGINALD E. GILLMOR RECEIVES MELVILLE MEDAL FROM PRESIDENT E. G. BAILEY

EDWIN H. LAND HONORED

(Mr. Land, *right*, receives the Holley Medal from President E. G. Bailey while Ely C. Hutchinson reads the citation honoring him.)

M.I.T. MAN HONORED

(Dr. Frederick G. Keyes, *right*, head of the department of chemistry at M.I.T., receives the ASME Medal from President E. G. Bailey.)

ASME Medal to Frederick G. Keyes, "Eminent in science, chemistry, and thermodynamics, for his many fundamental contributions to the advancement of mechanical engineering."

HONORARY MEMBERS

Each year the Society elects to honorary membership a maximum of five engineers who have made significant contributions to the engineering profession. This year the engineers so honored were: Carl F. Braun, president, C. F. Braun and Company, Alhambra, Calif.; Lyman J. Briggs, director emeritus, National Bureau of Standards, Washington, D. C.; James W. Parker, Fellow ASME, president, The Detroit Edison Company, Detroit, Mich.; Oscar A. Leutwiler, Mem. ASME, professor emeritus, University of Illinois, Urbana, Ill.; and George I. Rockwood, Fellow ASME, chairman, Board of Trustees, Worcester Polytechnic Institute, Worcester, Mass. Dr. Briggs was not present because of illness in his family and arrangements will be made for the presentation of his honorary-membership certificate at an appropriate ceremony elsewhere.

JOHN FRITZ MEDAL

This year the Society had the honor of presenting at its Annual Meeting the John Fritz Medal, the pre-eminent engineering medal of the nation, to one of its members, Dr. Theodor von Kámán, director, Guggenheim Laboratory, California Institute of Technology. The medal is a joint award of the ASCE, AIME, ASME, and AIEE. In the presentation, Dr. von Kármán was cited as a "creative leader, stimulating teacher, and wise counselor in engineering and physical research in the fields of aeronautical and structural sciences and widely known for his many applications of mathematical and physical theory to the sound solution of engineering problems."

THEODOR VON KÁRMÁN RECIPIENT OF JOHN FRITZ MEDAL

(Dr. von Kármán, *center*, is congratulated by Dr. D. Robert Yarnall, *left*, Past-President ASME and a member of the John Fritz Medal Board of Award, with Sir Frank Whittle of London, *right*.)

Biographical sketches of the recipients of honors and awards will be found on pages 80–85 of this issue.

PRESIDENTS INTRODUCED

Following the presentation of the honors and awards, Mr. Gates called upon the newly elected vice-presidents and directors at large to stand and receive the applause of the audience. He then introduced President-Elect James M. Todd, who, in a brief address, pledged himself to the service of the Society and the engineering profession. Attributing some of the success of engineers to the patience and sacrifices of the women behind them, Mr. Gates asked Mrs. Todd to rise. Whereupon she was given a rousing cheer by all present.

Mr. Gates then presented President E. G. Bailey who made the main address. His topic was "Engineering Opportunities in Industry." The full text of President Bailey's talk appears on pages 5 to 7 of this issue.

Mr. Bailey began with a tribute to the late Roy V. Wright, past-president and honorary member ASME, whose faith in the engineer as a responsible citizen led to the organization in the Society of the Engineers Civic Responsibility Committee. Through the initiative of this committee 15 million people, many perhaps for the first time, heard two engineers discuss the impact of engineering on modern culture. President Bailey expressed the appreciation of the Society for the admirable way in which L. J. Fletcher and William L. Batt represented the engineering profession on the "America's Town Hall Meeting of the Air" radio program.

ENGINEERS IN INDUSTRY

In his prepared address President Bailey warned that although science, and engineering, and industry have enriched the world in material things and have provided such services as power, transportation, and communication, equivalent progress has not been made in the realm of human relations.

Referring to the changes which have taken place in industrial management, he said that it is now largely in the hands of competent men who have worked up within the industry and generally within the individual company.

Decrying the tendency to regard the engineer as fitted only for association with the drafting board, slide rule, and machine shop, he stated that the engineer's approach in his everyday work fits him admirably for the realistic analysis of problems, regardless of their source. Industry in the future would require more of the engineering type of planning, he declared. Also, with his knowledge of economics and human

MRS. JAMES M. TODD AND PRESIDENT-ELECT TODD CHAT WITH MRS. E. G. BAILEY AND PRESIDENT BAILEY relations, the engineering manager is well-fitted to tackle some of the unfinished business of industry, which, he said, was in need of better knowledge of its good and bad points; more concentration on the job of teaching the public of its usefulness and integrity; and learning and then teaching its customers, and the public, the basic facts about fundamental economics.

Mr. Gates closed the dinner meeting after which a reception was tendered to the presidents and their wives, Mr. and Mrs. E. G. Bailey and Mr. and Mrs. James M. Todd. Dancing followed in the Georgian Room.

TECHNICAL PROGRAM

A comprehensive program of some 72 technical sessions at which nearly 200 papers were presented highlighted the 1948 Annual Meeting. Such diversified subjects as gas turbines for aircraft, railroad, and central-station use; supersonic flight and rocketry; developments in rubber, plastics, and textiles of the past year; safety-boiler codes; pressure-vessel research; metal-cutting techniques; and the science of prosthesis—the design and fitting of artificial limbs—and the engineer's part in this important phase of rehabilitation, were presented by leading engineers. Other panels, reports, and symposiums included a discussion of heat balance by hydraulic engineers; a railroad meeting which dealt with nondestructive testing of parts and assemblies from motive power and rolling stock; furnace performance factors; properties of gases; automatic control of steam plants; modern reheat turbines; marine power; and boiler feedwater studies. Technical sessions were also held in education, management, production engineering, materials handling, machine design, fuels, instruments and regulators, petroleum, oil and gas power, process industries, heat transfer, lubrication, and fluid meters.

WALTER G. VINCENTI, *right*, RECEIVES THE PI TAU SIGMA MEDAL FROM PROF. B. R. JENNINGS, PRESIDENT OF THE FRATERNITY

SECRETARY OF THE ASME AND NEW PRESIDENT FOR 1949

(James M. Todd, *right*, is congratulated by C. E. Davies, Secretary ASME, as Mr. Todd is installed in office for 1949.)

Pages 86–88 contain a list of the more than 135 preprints that were made available at the meeting. The list is arranged according to divisions and committees. In the ASME Technical Digest section of the November, 1948, issue of MECHANICAL ENGINEERING 13 digests of Annual Meeting preprints were published; in the December, 1948, issue 34 appeared; and this issue contains 49 digests, pp. 36–50. Digests of any remaining Annual Meeting preprints will be published in the ASME Technical Digest section of forthcoming issues of MECHANICAL ENGINEERING.

Pamphlet copies of the preprints are available from the ASME Order Department, 29 West 39th St., New York 18, N. Y. In ordering please give title, author, and paper number. Price, 25 cents per copy to ASME members.

MANAGEMENT AND EDUCATION

KEYNOTE LUNCHEON

With E. G. Bailey, President of the Society presiding, the 1948 Keynote Luncheon, held in the ballroom on Monday noon, set the stage for the entire meeting. The speaker was L. A. Appley, Associate ASME, president, American Management Association, New York, and the title of his address was "Opportunity for and Responsibility to the Young Graduate in Industry."

If the American system of free enterprise is to survive, Mr. Appley declared, it must have a greater number of "industrial statesmen." He defined the industrial statesman as the one who "fully realizes the driving motive inside of individuals to create something and who fosters it and gives it opportunity to express itself fully and quickly."

Mr. Appley said the greatest satisfaction to an engineer is the realization that he is creating or assisting in creation.

AS THE RUSH STARTS FOR REGISTRATION

With American management and its conduct of free enterprise "on trial at the bar of public opinion," survival of the system depends on management, he said, and in particular on management's ability to select and train its successors.

"Seven years of full employment at rising real wages has set a standard of performance that will not be easy to maintain," said Mr. Appley. "The competence which we can give to the young man today will largely determine the status of industry tomorrow."

It is the young engineer, he declared, who largely will determine the potential rate of economic progress.

"When we examine the nature and causes of increasing productivity in the past, it becomes apparent that they can be traced largely to improvements in technology," asserted Mr. Appley. "The myriad of inventions, methods improvement, materials handling, production planning, work measurement, the combination of the new knowledge in the most advantageous fashion have, in fact, contributed more to rising productivity and increasing standards of living than any other managerial activity."

He declared the engineer's role is especially vital in the sphere of foreign relations, and with the success of our foreign-aid program, depending to a considerable extent on the application of American "know-how."

Mr. Appley cited also the engineer's role in "sustaining and strengthening the armed might of democratic countries all over the world in deadly rivalry with the rising tide of destructive forces beyond the seas."

"But," he warned, "these are tasks which can be supported only if management continues to exercise and improve its obligation to the engineering profession. It is nothing short of criminal to permit a young graduate engineer, with the investment, training, development, and potential he represents, to shift for himself without planned guidance and help, in the hope he will absorb or inhale what he needs to know or acquire about assigned work.

"If businessmen expect to find qualified hands in which to place the future or their businesses and the nation's economic health, they cannot sit back and wait for tomorrow's engineers to come knocking at their office doors. They must actively engage in their development—now."

Mr. Appley's address will be published in a future issue of this magazine.

KEYNOTE SESSION

Following Mr. Appley's address, with H. N. Muller, Jr., Mem. ASME, manager, Educational Department, Westinghouse Electric Company, East Pittsburgh, Pa., in the chair, the keynote session, under the auspices of the Education Committee and the Management Division, was convened. Three papers were presented: "Whither Engineering Employment," by A. A. Potter, Honorary Member ASME, dean of engineering, and F. Lynn Cason, co-ordinator of placement, Purdue University, West Lafayette, Ind.; "The Government and the Future Employment of Engineers," by M. W. Trytten, Research Council, Washington, D. C.; and "The Small Manufacturing Company as an Opportunity for Engineering Graduates," by Crosby Field, Fellow ASME, president, Flakice Corporation, Brooklyn, N. Y.

MANAGEMENT LUNCHEON

On Wednesday noon the Management Division held its annual luncheon in the ballroom of the Hotel Pennsylvania with Wm. R. Mullee and J. Keith Louden presiding. The luncheon was addressed by H. B. Maynard, Member ASME, president, Methods Engineering Council, Pittsburgh, Pa., who had been named the 1948 Towne Lecturer.

Application of the scientific-management method to government can be an important factor in eliminating the "obstacle of war" from the world, said Mr. Maynard. Asserting that scientific management has within itself the "seeds of peace," he said that the world is in its present state because of a "lack of application of the principles of sound management to national and international affairs."

Mr. Maynard characterized scientific management as the "constructive force which offers real hope for the future to those who are concerned with the development of a better life," and said it was "both a philosophy and a group of techniques."

He pointed out that scientific management is commonly thought of in connection with greater productivity. "But if our goals become of a more spiritual nature—as, for example, greater human satisfactions from life as some advanced thinkers abroad are beginning to suggest—scientific management can accomplish this too," he continued.

Mr. Maynard stated that the restoration of Europe's productivity to near prewar levels will not be sufficient. Europe must be much more productive than it ever was before the war if it is to enjoy the modern standard of living. He said this is not a European problem alone but a matter of concern for everyone in America.

"As long as large groups of people in Europe are forced to exist at the subsistence level, so that they have no particular stake in the established economy of their countries, then we can expect unrest, a willingness to go off on unsound economic tangents, and even a mental readiness for war," he continued.

In Europe, the scientific-management movement is really only just now beginning to get under way, Mr. Maynard declared. It required the destructions of war to bring home the fact that "production is the only real basis for material prosperity.

"With this realization came a real enthusiasm for scientific management which promises greater production. A steadily increasing stream of publications dealing with scientific-management procedures and techniques is beginning to reach us from overseas, tangible evidence of the new vitality of the movement abroad."

After pointing out that there is a world-wide labor shortage, Mr. Maynard said:

"With this trend developing in nearly every country in the world, including our own, it appears—if we can avoid the major upheaval of another war—that we are in for the greatest industrial expansion that the world has ever seen. People want more things. The old fears of technological unemployment are disappearing as the result of the assurance given by better social programs throughout the world and the growing acceptance of the fact that to have we must produce."

In discussing whether or not the world would be content with a high standard of peaceful living, Mr. Maynard said that scientific management has within itself the "seeds of peace."

"Scientific management never uses force to accomplish its objectives," he stated. "It seeks first to understand the laws of the situation. Then it eliminates the obstacles to accomplishment and provides incentives which will cause people to wish to do what is best for the good of the enterprise.

"Scientific management recognizes the value of incentives. Then why not incentives for peace, properly defined, established, publicized, and sold? If the scientific approach can be carried over into government, then at last there is hope for the future."

Mr. Maynard said there are signs that this is taking place.

"Scientific management is beginning to get into the more technical levels of government. The Society for the Advancement of Management, for example, has a government-relations division which is encouraging the application of scientific management to government activities. The Army and Navy have finally dropped their 36-year-old restrictions against the use of time study and the same kind of thing is beginning to happen within government circles in other countries.

"It is a hopeful development, for from this modest beginning the scientific approach is bound to spread upward through the years and will eventually affect the higher levels. Cold scientific reason will probably never prevail entirely in the management of human affairs, but the scientific approach can recognize the emotional factors which exist within any situation and perhaps can learn to control them."

The text of Mr. Maynard's address will be published in a later issue of this magazine.

OTHER MANAGEMENT SESSIONS

Several other sessions of the Management Division were held during the 1948 Annual Meeting.

On Monday morning the Management Division co-operated in a session with the Production Engineering Division, with J. F. Young presiding. The subject, "Can Management Afford Not to Be Quality-Conscious," was discussed by W. A. MacCrehan, Jr., of New York University; and Dorian Shainin, Member ASME, chief inspector, Hamilton Standard Propellers Division, United Aircraft Corporation, East Hartford, Conn., spoke on "Statistical Inspection Pictures Cut Material Procurement Costs" (paper No. 48—A-88).

L. R. Boulware, vice-president, Employee Relations, General Electric Company, New York, N. Y., and some of his associates addressed the Management Division on Monday evening describing "General Electric's Employee and Community Relations Presentation to Supervisors and Professional Employees." These talks were illustrated with the material used in the company's programs.

A session on Tuesday morning presented a critical comparison of management tools at home and abroad—time and motion study.

A second session of the Management Division in co-operation with the Production Engineering Division was held on Tuesday afternoon. Two papers on statistics and management, by W. A. Shewhart, Bell Laboratories, Murray Hill, N. J., and J. M. Juran, Member ASME, of New York University, were presented.

On Wednesday morning the Management Division presented a panel discussion of the subject "Management—A Trusteeship," with J. M. Juran, J. Keith Louden, and Philip P. Glassey, Member ASME, vice-president, Easy Washing Machine Corporation, Syracuse, N. Y., participating.

The concluding session of the Management Division, the Education Committee co-operating, was held on Wednesday afternoon with Dr. Lillian M. Gilbreth, Fellow ASME, presiding. President Bailey delivered the introductory remarks on the general topic, "Opportunities for the American Engineer Abroad." Lloyd J. Hughlett, managing editor, McGraw-Hill International Corporation, New York, N. Y., spoke on "Opportunities and Requirements for U. S. Engineers Abroad" (paper No. 48—A-121); and Lawrence Duggan, president, The Institute of International Education, New York, on "Some Implications of Foreign Service in the Engineering Field."

The Division co-operated also in the symposium on biomechanics.

EDUCATION SESSIONS

In addition to sessions held in co-operation with the Management Division the Education Committee conducted an excellent discussion of the subject of creative engineering, on Tuesday morning. Charles A. Davis, Member ASME, La Salle Steel Company, Chicago, Ill., presided. K. W. Vaughn, director of research, Educational Research Corporation, Cambridge, Mass., spoke on "The Raw Materials of a Program of Creative Engineering;" Neil P. Bailey, Member ASME, of Rensselaer Polytechnic Institute, on "Creative Teaching;" and T. E. Shea, president, Teletype Corporation, Chicago, Ill., on "An Industrial Point of View on Creative Engineering."

ASME TOWN HALL BROADCAST

For one hour on Tuesday evening, Nov. 30, the 1948 Annual Meeting was freed by engineering and science from limitations imposed on it by headquarters hotel. Fifteen million people heard and thousands more saw and heard two engineers defend engineering contributions to modern living against an educator and a churchman, who saw in the work of the engineer a force acting to undermine ancient ideals of morality and human happiness.

The question debated from the stage of Town Hall, New York, N. Y., was "Are Our Ideals Being Destroyed by the Machine Age?" Speaking for the affirmative were Dr. John Haynes Holmes, pastor of the Community Church of New York, and Dr. Clark G. Kuebler, president of Ripon College, Ripon, Wis.; for the negative William L. Batt, past-president and Honorary Member ASME, and L. J. Fletcher, Mem. ASME, director of training and community relations, Caterpillar Tractor Company, Peoria, Ill.

Strong as was the indictment pronounced by Dr. Holmes against the machine age for its alleged cheapening, vulgariza-

ASME PUBLICATIONS ON DISPLAY

tion, and the "prostitution" brought by the machine into human life, there was a general agreement among all speakers before the debate was over that it was not so much the machine as man and his misuse of the machine which was the basis of the irritations in modern life.

Thirty minutes before the broadcast time, George V. Denny, Jr., moderator, came on a stage set with microphones and television cameras, and introduced himself to the audience. During this warming-up period, a show of hands by ASME members convinced him that the house had been "packed" by the opposition. Several members of the audience were asked to define what was meant by "our ideals" and others to express opinions on the subject of the evening. As broadcast time approached, the announcer, radio and television technicians, production manager, and the Town Crier dressed as a colonial New Yorker appeared in the wings. Mr. Denny gave his final instruction to the audience, the speakers took their places, and the show was on.

In his indictment of the machine age, Dr. Holmes referred to the use of the atomic bomb in World War II as symbolic of the materialization, brutilization, and demoralization of modern living, not so much by the machine, which he said was as old as the wheel, but by mechanical and electrical power produced by the machine only two centuries ago.

In a petty, cruel, and corrupt age, largely shaped by the power machine, at least two things were possible, he said. "We can get rid of the machine by destroying it or outlawing it" or "we can tame the machine and subdue it to our uses, therewith disentangling the good from the evil that it does. This waits upon such a spiritual awakening as will shake mankind like an earthquake."

In concluding he said, "The dilemma is easy. 'Choose you this day whom ye shall serve.' "

Mr. Batt, who was the first speaker for the negative, defined our ideas as "the quality of constant betterment" in material and as well as spiritual things.

The opportunities for a better life are greater today, he said, "because of the wide distribution made possible by the machine age. There is an immense variety of literature available to us from the great novels of the past to the daily newspaper of modern times. Motion pictures, radio, and television, the product of a machine age, have opened new fields in entertainment and education. With mechanical power came the railroad and airplane, extending travel beyond anything imagined before. These enlarged opportunities for self-improvement cannot be other than a force for good."

"All of these things are ideals or standards. Man has always kept ideals before him, goals to be attained. The machine age has enriched them instead of destroying them," he concluded.

As the second speaker for the affirmative, Dr. Kuebler, while acknowledging the benefits of science and technology, warned of two dangers inherent in the machine age; first, the tendency of the machine to mechanize and to dehumanize man—to destroy his initiative and to make him less capable of democracy and thus ripen him for plucking by totalitarianism; secondly, the tendency of the machine to promote mechanical materialism and lead to the assumption that science and technology are sufficient for the development of a good society.

Dr. Kuebler stated in conclusion that "our machine age can continue to be of increasing benefit to mankind provided that man concern himself even more with moral and spiritual ends than with mechanical means, but up to now the machine age has tended to blind him to ultimate values."

Mr. Fletcher, after reviewing the arguments of the other speakers, asked whether this really was the machine age. It seemed to him more like the age of misunderstanding in which the machine was the scapegoat for all our social ills. As tangible evidence of the vitality of present-day ideals, Mr. Fletcher called attention to the great quantities of farm products and money being collected and sent abroad by the Christian Rural Overseas Program in which 75,000 people are participating.

In an age of specialization in which people are growing apart and becoming strangers within their own communities, we needed to devote leisure time created by the machine to recreate understanding. He cited the experience of his home town, Peoria, Ill., where industry, the church, and the schools were devoting machine-age leisure time to a weekly radio program for discussion of "hot subjects with cool heads."

The machine is the servant of this age, Mr. Fletcher concluded, "misunderstood in its newness, a giant in its possibilities for greater good."

In the question period which followed the prepared statements, it was apparent that the four speakers were close to agreement on at least one point: That if our ideals were truly in danger, it was not in science and engineering but in man himself, in his lack of knowledge and his immorality, where the danger to our ideals lay.

OPERATION "TOWN HALL"

Commenting on the Town Hall broadcast, F. A. Faville, chairman, Engineers Civic Responsibility Committee said:

"What did the Civic Responsibility Committee hope to prove in bringing ASME before an audience of 15,000,000 people? What did it have to do with civic responsibility? What is the most urgent assignment facing us as engineers and as citizens? At least the program gave us our brief moment on the stage.

"Leonard J. Fletcher named our era the Age of Misunderstanding, rather than the Machine Age. Unfortunately, time permitted only a brief look at the engineer and his creations and could not hope to reflect fully contemporary engineering thinking.

"It is too bad we could not reflect more of L. R. Boulware's message[1]—that people so misunderstand our industrial system that the General Electric Company is making the task of correcting misunderstanding the number-one assignment of the company, on both an employee and a community basis. This assignment is taking precedence over every other activity.

"It is too bad the Town Hall audience could not have heard the Keynote address[2] of L. A. Appley. Strangely enough, both George V. Denny, Jr., in his Town Hall introduction, and Mr. Appley talked about our constitutional rights of life, liberty, and the pursuit of happiness. It is too bad that in our brief moment on the stage time prevented giving more of Mr. Appley's formula on the pursuit of happiness: That it is only by expressing his creative impulse that man's instinct for happiness can be satisfied.

"Mr. Appley's references to Dr. Robert E. Doherty, president of Carnegie Institute of Technology, who states that "our great institutions in America were produced by great minds, thinking great thoughts, to a great purpose," and Mr. Appley's conclusion that "there can be only unhappiness in any form of statism, which only equalizes scarcity," are worthy of repetition.

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[1] Management session held on Monday evening of ASME 1948 Annual Meeting, at which L. R. Boulware, vice-president, employee relations, and his associates described General Electric's employee and community-relations presentation to supervisors and professional employees.—EDITOR.

[2] "Opportunity for and Responsibility to the Young Graduate Engineer in Industry," by L. A. Appley, Assoc. ASME, president, American Management Association, New York, N. Y., presented at Keynote Luncheon, 1948 ASME Annual Meeting, Monday, Nov. 29, 1948. To be published in a later issue.—EDITOR.

"The engineer deals almost entirely in mental conceptions. His basic philosophy is to harm no man and to do good for all mankind. His basic ideas are conceived from the needs of man and are then given reality in material, workable gadgets. Giving reality to these ideas has revolutionized our civilization and has forced us to think in world-wide terms: the transmission of energy through wires, multiple communications through the same wire, communications through the air itself, yes, even pictures by means of television. Can anyone question that Creation is still in the process of unfolding?

"Mr. Fletcher said that an idea is the only thing you can give away and still keep. Although Thomas A. Edison and Roy V. Wright are no longer alive, their ideas are more alive and real today than ever before. If we consider the ideas of the Machine Age as a continuation of Creation, then we well may, as Dr. Clark Keubler stated, 'join hands in the interests of faster progress.' "

"Operation Town Hall had a far deeper significance than bringing the engineer 'out of the kitchen into a parlor' with 15,000,000 people. Mr. Denny cautioned us that in this parlor of 15,000,000 folks are many who do not think of ideas; they think only of things. They think not in terms of faith, hope, and charity, but of material objects—of tin cans and of fishhooks. 'To you it is given to understand, but to them it is not given.' If the television picture or the audible speech seems to the listener to be blurred, he can turn the switch, get out of tune with the wave, and leave the parlor. We had to talk about the material accomplishments of the Machine Age to keep the 15,000,000 folks in the parlor, but many listeners saw a new side of engineering thinking—that engineers think also of human problems and are *also* spiritual beings.

"ASME is indebted to George V. Denny, Jr., and to Town Hall for the opportunity to talk with this vast radio audience. The great response accorded the program by wire and by letter assures us this public is glad to know engineers as human beings—just like William L. Batt and Leonard J. Fletcher."

PROSTHESIS SYMPOSIUM

Application of engineering principles to improve the adaptability, appearance, and comfort of the amputee through the selection of proper materials and reduction in weight of artificial limbs, was explained on Tuesday evening of the ASME Annual Meeting during a symposium on prosthesis and biomechanics.

MECHANICS OF ARTIFICIAL ARM DISCUSSED

A paper by Gilbert M. Motis, supervisor of prosthesis development, Northrop Aircraft, Inc., Hawthorne, Calif., read by E. F. Murphy, chairman of the meeting, pointed out that materials have proved to be the greatest contribution by reducing weight and condensing space requirements so that more complex mechanisms, necessary for multiple functions, could be incorporated.

In discussing mechanics of the artificial arm, Mr. Motis' paper stated that the development of plastic-laminated forearms and sockets, with the hinges and fittings of aluminum alloy bonded into the plastic, eliminates all need for riveting or gluing.

In evaluating the advantages of plastic over the formerly used willow wood, fiber, and metal, it was reported that the complete arm is washable with soap and water and does not retain odor because of its nonporous base. Coloring is added to the "stockinette" laminate before it is impregnated with plastic. Finished in this way, there is no marring of the surface when scratched or bumped. The strength-weight ratio of this type of construction affords the amputee much more comfort and ease in operation. The stump socket fits the contours of the stump perfectly, because it is made from an impression mold of the individual amputee.

Efficiency of the control system of the artificial arm was increased to 42 per cent by the use of a 0.062-in-diam stainless-steel aircraft control cable operated through a close-wound stainless-steel housing. This represents an increase of approximately 12 per cent over the formerly used leather thong or "catgut."

According to the Motis paper, the life of these cables was not sufficient due to the lack of proper lubrication, which was necessarily eliminated to prevent soiled clothing. Tinplating of carbon-steel cable has now provided a longer life without a lubricant.

The latest improvement in the efficiency of the control system is a $^1/_8$-in-diam ball-and-socket chain, that is free to bend in any direction and the links may rotate. This allows transmission around bends and into a plane 90 deg to the normal plane without the addition of swivel joints.

An elbow lock mechanism for the above-elbow amputee has been developed and operates by a shrug of the shoulder rather than the previous method of a push button under the forearm, which was operated by pressure against some part of the body or a piece of furniture. A wrist mechanism for the below-elbow amputee has been developed which rotates the hook with the remaining rotation available from the stump.

Aluminum-alloy parts are used in the majority of units to reduce weight as much as possible, it was pointed out. Magnesium has been used, but the finish was not satisfactory for extensive use of the parts in arms. Recently, a method of chrome plating has been developed by a magnesium company and is being investigated as a possible solution.

DESIGN FOR LOWER-EXTREMITY PROSTHESIS

A research program of fundamental studies of locomotion and experimental techniques at the University of California has been sponsored by the Advisory Committee on Artificial Limbs of the National Research Council and the Veteran's Administration, according to John G. Catranis, president, Catranis, Inc., Syracuse, N. Y. This program, now three years' old, is concerned with the collection of fundamental data through functional studies, including anthropological, x-ray, locomotion, force plate, high-speed-camera studies, experiments with prosthesis on treadmills, stairs, inclines, and other walking tests for slow, normal, and fast walking. He discussed the application of fundamental design to lower-extremity prosthesis and presented information relative to the most recent developments.

To assure optimum functional improvements, detailed investigations were made of prior studies and developments in the art of prosthesis. In order to evaluate the various developments under consideration, Mr. Catranis revealed that research into functional and structural analysis and testing is being undertaken. These analyses are concerned not only with functional qualities but also structural durability, he said.

Structural analyses and improvement activities are directed toward producing a light limb which can withstand service tentatively set at 3,000,000 cycles, this value assumed to approximate three years of normal service, Mr. Catranis stated.

STUDIES OF NORMAL WALKING

The mechanism of normal level walking, obtained through the use of a 35-mm motion-picture camera with a specially designed "force plate," was the subject discussed by B. Bresler, research engineer and assistant professor of civil engineering, University of California at Berkeley, Calif., and J. P. Frankel, research engineer and instructor, University of California at Los Angeles, Calif.

The data were presented in terms of the displacements of and the force systems at the leg joints. Material on four normal subjects was obtained from simultaneous recording of the positions of the leg in space and the floor reactions during level walking. The mass moments of inertia of the lower extremity were determined experimentally and the effects of gravity and inertia were included in the analysis.

The forces and moments were presented in terms of the space components referred to a system of horizontal and vertical orthogonal axes.

OUTLOOK FOR BIOMECHANICS

In a talk on the outlook for biomechanics, Luis de Florez, Mem. ASME, vice-president, de Florez Engineering Company, New York, N. Y., appealed for closer contact between the medical and engineering professions on work such as prosthetic devices. He cited the good work being done by the engineering societies relative to prosthetics but pointed out that a large gap still exists between the engineering and medical sciences.

He emphasized that it was highly important for doctors and engineers to get together to solve common problems. Another point suggested by Mr. de Florez was to disseminate related technical papers to both doctors and engineers in common easily understood terms.

NUCLEAR ENERGY

A special round-table discussion of "Industrial Uses of Heat Energy From Nuclear Fission" was conducted on Thursday evening and attracted a large and interested audience. Alex D. Bailey, past-president ASME, presided. The members of the panel were: Sumner Pike, member, Atomic Energy Commission; James W. Parker, past-president and Honorary Member, ASME, chairman, Industrial Advisory Committee to the Atomic Energy Commission; Dr. James B. Fisk, director of research, U. S. Atomic Energy Commission, 1947–August, 1948, presently of Harvard University; Dr. John J. Grebe, physical research laboratory, Dow Chemical Company, Midland, Mich.; Capt. Hyman G. Rickover, Bureau of Ships, U. S. Navy; and Walker Cisler, consultant to the Atomic Energy Commission, executive vice-president, The Detroit Edison Company, Detroit, Mich.

APPLIED MECHANICS DINNER

Obsolescence in engineering was the subject discussed by Harold Vagtborg, president, Southwest Research Institute, San Antonio, Texas, at the Applied Mechanics Dinner on Monday evening.

Mr. Vagtborg said that we can avoid obsolescence in engineering by better appreciating the relationship of science and engineering.

There should also be a closer liaison between science and discovery. He asked, "How many engineers ever read any of the journals or attend any of the meetings in these fields of science that are the 'door-openers' in their own professions?"

He advocated more formal training in the basic sciences behind engineering and less attention to its craftsmanship tradition.

Continued study after formal education was emphasized by Mr. Vagtborg. This is necessary to avoid human obsolescence, he said, so possible when one realizes that a professional life of 50 years will see several waves of new technological progress.

He pointed out that a "fresh approach" should be used and that the engineer should not be intimidated by tradition.

In conclusion, he said that obsolescence can be avoided by better realizing that science and engineering are the "endless frontier"—the only multipliers of our natural resources—and that "the surface has only been scratched" in the opportunities these offer the engineer who can meet their challenge.

As a part of the dinner program, a certificate for five years of valuable service to the ASME Applied Mechanics Division was presented to W. M. Murray, Mem. ASME, associate professor, Massachusetts Institute of Technology, Cambridge, Mass. He served as secretary of the Division in 1947, and as chairman during 1948.

Professor Murray was also the presiding officer at this year's dinner.

FUELS LUNCHEON

Immediate development of commercial synthetic-fuel plants is essential to the economic welfare and military security of the United States, W. C. Schroeder, chief, Office of Synthetic Liquid Fuels, Bureau of Mines, U. S. Department of the Interior, said at the Fuels Division luncheon on Wednesday. Mr. Schroeder stated that the current demand for petroleum has reached "awesome proportions" and still is rising.

Anticipated military requirements for any future war seem almost astronomical. Traditional wildcatting and geophysical exploration, which have met the need in the past, no longer provide the assurance that demands of the future will be met, he said.

Petroleum and its products being indispensable to the United States, the sources of our future supply are vital problems, he continued. Basic decisions must be made by the American people, by industry, and by the Congress.

After analyzing the present and future demand for liquid fuel, he stated that in order to meet the anticipated civilian requirement, an additional $1^{1}/_{2}$ to 2 million barrels a day will have to be obtained. He pointed out that it would be unwise to become dependent upon foreign sources, and said that synthetic oil from coal and oil shale offers an assured supply for hundreds of years within the borders of the United States—self-sufficiency in peace or war. Synthetic fuels can fill the gap between anticipated demand and supply, but only if immediate steps are taken to establish commercial plants.

He stated that sufficient data already are available to permit an immediate start on design work for the initial commercial plants, and he recommended that three or more commercial-size plants should be built as prototypes now, using both coal and oil shale as the raw materials. These model plants should be built and operated by private industry with financial assistance, if necessary, provided by the Reconstruction Finance Corporation.

With few exceptions, oil-company executives agree that coal, oil shale, and natural gas are destined to become a major source of oil supply, he said.

Legislation to accomplish this purpose was introduced during the last regular session of Congress, Mr. Schroeder stated. Hearings on the House Bill (H.R. 5475), introduced by Representative Charles A. Wolverton of New Jersey, were completed, and this Bill was reported favorably by the House Interstate and Foreign Commerce Committee. It was anticipated that the measure will come up at the next session.

Mr. Schroeder said that several operating synthetic-fuel plants, as envisaged by the Wolverton bill, would take us a long step forward toward our objective—self-sufficiency in oil for whatever the future holds. They would provide the essential link between pilot-plant research and commercial production, and a basis from which a large industry could grow very rapidly if necessary.

T. C. Cheasley, Mem. ASME, assistant to president, Sinclair

Coal Company, Kansas City, Mo., presided at the luncheon.

As a part of the program, Mr. Cheasley, who was secretary of the Fuels Division during 1947 and chairman in 1948, was awarded a certificate of appreciation for his five years of valuable service to the ASME Fuels Division.

GAS TURBINE POWER DIVISION DINNER

The annual dinner of the Gas Turbine Power Division was held on Tuesday, November 30, during which the First Gas Turbine Power Division Award was conferred on Charles G. Curtis, internationally known engineer and a pioneer in the field of gas turbines.

The award consisted of an engrossed certificate citing Mr. Curtis "for his pioneer work in the field of gas turbines, which resulted in his being granted, in 1899, the first American patent covering a complete gas-turbine power plant." The award was a "testimonial of appreciation for his efforts in the advancement of the gas-turbine art."

Mr. Curtis, who was born in Boston, Mass., in 1860, is still active as president of the International Curtis Marine Turbine Company, New York, N. Y. A prolific inventor, he is best known for his Curtis steam turbine, which he patented in 1896. Among his achievements is the development of a propelling mechanism for the torpedo, which was employed by this country from 1904 until five years ago.

J. T. Rettaliata, chairman of the Gas Turbine Power Division, and dean of engineering, Illinois Institute of Technology, Chicago, Ill., presided at the dinner and presented the award to Mr. Curtis. T. E. Purcell, vice-president ASME Region V, was toastmaster.

Following the presentation, Walter Cisler, Mem. ASME, andexecutive vice-president, The Detroit Edison Company, Detroit, Mich., spoke on "The Gas Turbine's Place in the World Power Field."

Because of the acute demand for electric power all over the world, Mr. Cisler said, the possibility of the gas turbine as a source of additional power offers this new medium a great opportunity, especially in countries such as France, where the solid-fuel reserves are not large. It was his opinion, he said, that the gas turbine would not replace the steam turbine but would be used as a second source of power at locations removed from the main generating plants to lessen line losses and to improve operation of the system.

IIRD LUNCHEON

The annual luncheon of the Industrial Instruments and Regulators Division, held on Wednesday, Dec. 1, was attended by more than 50 members and guests who heard President E. G. Bailey speak on "The Engineer's Opportunities in the Field of Instruments and Controls."

In his preliminary remarks President Bailey stated that background research and standardization were the basic services the Society rendered to the engineering profession. He urged the Division to investigate its antecedents and to emulate the group of men who thirty years ago conducted research on combustion-control instruments. This group, at a cost of only $39,000, produced basic information of tremendous value to the instruments industry.

He especially stressed the concept of "background research," the results of which were such tools as the steam tables and orifice coefficients. He called upon the Division to suggest research projects through its research secretary so that these could be co-ordinated by the Society's Research Committee.

In his prepared address President Bailey pointed to the aviation field as the one which offered great opportunity for the instrument designer and one whose problems demanded his greatest ingenuity. "Pilot error" he said, accounted for 70 per cent of the aviation accidents. This percentage could best be reduced by improving instruments at the disposal of the pilot to give him the information he needed to do his job. The new instruments, he said, must come from men who know the needs and habits of pilots.

In concluding, President Bailey cautioned against novelty in instrumentation, saying that true progress lay in solving for tomorrow the problems of today.

J. J. Grebe, retiring chairman of the Division, presided. He introduced H. L. Mason, the incoming chairman, who in turn announced personnel of subcommittees and introduced those who were present.

Prior to Mr. Bailey's talk, J. C. Peters, secretary of IIR Division, presented a Certificate of Award to Mr. Grebe in recognition of his services to the Division.

HYDRAULIC OLD TIMERS' DINNER

Members of the Hydraulic Division met informally for dinner Tuesday, Nov. 30, to enjoy old friends and to swap yarns. A warm welcome was extended to a delegation of distinguished Canadian engineers. Among those present was Dr. Robert W. Angus, Hon. Mem. ASME, professor emeritus of mechanical engineering, University of Toronto, Toronto, Can. D. J. McCormack, Mem. ASME, sales manager, S. Morgan Smith Company, York, Pa., was in charge of dinner arrangements.

TUESDAY LUNCHEONS

A history of the co-operative effort between the utility operating in Baton Rouge, La., and several large industrial users of steam and electricity was given by Joseph Pope, Mem. ASME, first vice-president, Stone and Webster Engineering Corporation, New York, N. Y., at the Power Luncheon. Similar arrangements between the Pacific Gas and Electric Company with oil companies on the Pacific Coast were described by V. F. Estcourt, Mem. ASME, Pacific Gas and Electric Company, San Francisco, Calif.; and K. M. Irwin, Mem. ASME, of the Philadelphia Electric Company, told how his company co-operates with the du Pont Company. J. I. Yellott, Mem. ASME, Locomotive Development Committee, Baltimore, Md., presided.

At the Machine Design Luncheon, H. A. Toulmin, Jr., Mem. ASME, Toulmin and Toulmin, Dayton, Ohio, spoke on the subject, "Patents and the Courts—Reform or Revolution." Mr. Toulmin's paper will appear in full in an early issue of MECHANICAL ENGINEERING. George F. Nordenholt, Member ASME, editor, *Product Engineering*, acted as toastmaster.

Cabin conditioning problems at supersonic velocities were discussed by M. Patterson, Wright-Patterson Air Force Base, Dayton, Ohio, at the Heat Transfer Luncheon. A. P. Colburn, Mem. ASME, University of Delaware, Newark, Del., presided.

TEXTILE DIVISION—ANNUAL MEETING

The ASME Textile Division again held its annual meeting with that of the ASME on Friday, Dec. 3. First on the program was breakfast which was followed by a business meeting. A. B. Studley, Mem. ASME, SKF Industries, Inc., Boston, Mass., chairman of the meeting, was presented with a certificate lauding him for valuable work and services given to the Textile Division. He is the retiring chairman.

The technical program was highlighted by seven technical papers which were presented at two sessions. At the first session, a new type of tensile-testing instrument, which utilizes electronic principles for both the weighing of the forces on the sample and for controlling its extension, was described. In another paper, the present status of bonded fabrics was discussed. A paper telling why the Warner & Swasey Company decided to build the Sulzer weaving machine was also presented.

At the second technical session, which followed a luncheon, four papers were presented on the following subjects: The challenge facing colleges today; electromechanics in textile-machinery drives; the strain gage as applied to loom study; and electrostatic air cleaning in the textile industry.

AMERICAN ROCKET SOCIETY

This year the third annual meeting of The American Rocket Society was again held jointly with the ASME Annual Meeting. The American Rocket Society became an affiliate of the ASME in 1945. Technical papers covering rocket performance, injector designs, high-pressure gas systems, and rocket materials highlighted the ARS technical program.

At the first ARS session on Thursday morning Charles H. Harry, pilotless-aircraft section, Glenn L. Martin Company, Baltimore, Md., presented a paper on "A Study of the Parameters Affecting Over-All Rocket Performance," and a paper discussing "A Survey of Injector Designs for Use With Liquid-Propellant Rocket Motors," was given by B. N. Abramson, rocket group engineer, Bell Aircraft Corporation, Buffalo, N. Y.

At the second ARS session the "Creation of a High-Pressure Gas Source for Rocket-Motor Propellant-Supply System (5000 Psi Upward)," was discussed by C. J. Turansky and R. J. Rinehart, rocket group engineers, Bell Aircraft Corporation, Buffalo, N. Y. L. G. Bonner, technical director, Ballistics Laboratory, Cumberland, Md., spoke on "Metal Parts for Solid-Propellant Rockets."

Complete copies of the foregoing papers are available from The American Rocket Society, 29 West 39th Street, New York 18, N. Y., at a nominal cost.

ROCKET LUNCHEON

Ground has already been broken for the U. S. Air Force high-thrust rocket test station located on the northeast corner of the Muroc Air Force Base, in California, it was revealed by K. F. Mundt, chief engineer, Aerojet Engineering Corporation, Azusa, Calif., in a talk which he gave at the ARS luncheon on Thursday. The new complete self-contained test station is to have facilities at which all of the high-thrust rocket engines under contract to be developed could be tested.

Five test stands and two control stations are contemplated, according to Mr. Mundt. Three of the test stands are designed to test rocket engines or missiles within the maximum nominal thrust stipulated for the station. The other two test stands will be used to test only rocket engines, one within the maximum nominal thrust stipulated for the station and the second for a nominal thrust of half of the maximum.

The requirements for these stands, Mr. Mundt said, were determined by the large rocket-motor development programs under contract to several missile and engine contractors.

It is planned that the two rocket-engine test stands can be used for the testing of solid-propellant booster rockets or for the testing of continuous operating liquid-propellant rocket engines for use on inhabited aircraft, he stated.

The control stations will be located adjacent to the test stands which they are to serve and will be cut into the rock of adjoining hillsides in order to reduce possible blast hazard.

In addition, Mr. Mundt reported that the new test station will include facilities such as components test laboratories, storage, machine shops, housing, fire protection, roads, power, water, and the like.

The goal, as outlined in the plan for this rocket test station, he pointed out, has charted the course of a logical program of growth which will, if followed, result in the finest rocket-engine test center in the world.

Charles A. Villiers, president of The American Rocket Society, presided at the luncheon.

AVIATION-ROCKET DINNER

Rockets as research tools in aeronautics was the subject of an address given by Dr. Hugh L. Dryden, Mem. ASME, director of aeronautical research, National Advisory Committee for Aeronautics, Washington, D. C., before the joint ASME Aviation Division-American Rocket Society dinner on Thursday. He told the guests that extremely high fuel consumption makes it doubtful whether rocket engines will be used as the principal power plant of a practically useful aircraft.

Mr. Dryden pointed out that the research airplane, Bell X-1, which recently flew faster than the speed of sound, was powered by a 210-lb rocket engine that requires 8177 lb of fuel for $2\frac{1}{2}$ min of flight at full power. This is a Reaction Motors engine, he said, which uses liquid fuel, ethyl alcohol, and liquid oxygen, in four chambers, each giving 1500 lb thrust.

Within the last three years rockets have become essential research tools in advancing aeronautical knowledge, and it was in this connection that the rocket engine was used in the Bell X-1, he revealed.

This airplane and several others were planned by the NACA, U. S. Air Force, and U. S. Navy as a means of obtaining data for the design of practical supersonic aircraft. The X-1, said Dr. Dryden, is of conventional subsonic design and only a rocket engine could give sufficient power to force it through the air at supersonic speeds and then only at high altitude. The other airplanes in the series are of a design better-suited to supersonic flight.

Rockets are being used also in gathering data about the high upper atmosphere. He emphasized that if supersonic flight is to be economical, it must be carried out at very high altitude. Development will be facilitated by sufficient knowledge of conditions there to permit reproduction of these conditions in laboratories on the ground. The sounding rocket makes this possible.

The method of rocket-propelled models is one of the few methods available for obtaining data in the region near the speed of sound other than actual flight, he said. Wind tunnels, the usual tool, become useless in this region because a normal shock wave forms across the entire stream, choking the flow.

As a result of the great stimulus to the development of

AT THE AVIATION-ROCKET DINNER

(*Left to right:* Prof. F. E. Teichman, Dr. Hugh L. Dryden, Mrs. Robert H. Goddard, and Dr. G. Edward Pendray.)

AMERICAN-BRITISH-CANADIAN AMITY

(Clarence E. Davies of New York, *left*, Secretary of The American Society of Mechanical Engineers, and two notable guests at the Society's 69th Annual Meeting in New York; Sir Frank Whittle, *center*, Air Commodore, RAF, rtd., now consultant with British Overseas Airways Corporation, who invented the turbojet engine; and L. Austin Wright, Secretary of the Engineering Institute of Canada.)

rockets provided by World War II, NACA in 1945 established a special research station at Wallops Island, on the Atlantic seacoast of the eastern Virginia peninsula. There, by means of rocket-propelled models at speeds up to about twice the speed of sound, investigations have been made of the basic aerodynamic characteristics of wings and bodies as affected by the wing and body shape and the air speed, on the flutter of wings at high speeds, and on automatic stability and control of missiles.

Dr. Dryden said dynamically scaled models of actual aircraft also have been studied in free flight for characteristics at high speeds as a prelude to piloted flight. This eliminated many of the risks of venturing into the transonic speed region near the speed of sound.

Dr. Dryden also presented a motion picture showing the actual flight tests of the various rockets being developed by NACA for sounding the upper atmosphere, investigating wing and body shape, wing flutter, and stability and control.

ARS ANNUAL AWARDS

This year marked the first presentation of the American Rocket Society annual awards to outstanding engineers in the field of rockets and jet propulsion. The awards were given by G. Edward Pendray, Mem. ASME, president, Pendray and Liebert, New York, N. Y., who was toastmaster at the dinner. Presentations were as follows:

The Goddard Memorial Award, a gold medal, was presented to John Shesta, director of research and engineering, Reaction Motors, Inc., for his long-time interest in the American Rocket Society and his outstanding work at Reaction Motors, Inc.

The C. N. Hickman Award, a silver medal, was given to Frank J. Malina of UNESCO, for his work in connection with the establishment of Galcit and the Aerojet Engineering Corporation, and for his original work on the WAC Corporal Rocket.

The American Rocket Society Junior Award, a bronze medal, was presented to a group of four students from CCNY who, in the course of their engineering laboratory work, completed a project on the "Design and Experimentation in Rocket Thrust Cylinder" and presented a paper on their project to the Awards Committee. The four students, now employed, are: Noel Rothmanyer, Kellex Corporation; Arthur Sherman, Reaction Motors, Inc.; A. Bernstein, Picatinny Arsenal, and David Lindser, Curtis Wright Corporation.

In addition, Mrs. Robert H. Goddard, widow of Dr. Robert H. Goddard, sometimes known as "the father of rocketry," was made the first honorary member of the American Rocket Society.

F. E. Teichman, professor and retiring chairman of the ASME Aviation Division, was also honored at this dinner when a certificate for his valuable services rendered the Aviation Division was presented to him.

COMMITTEE MEETINGS

In addition to technical sessions and other gatherings of a more public nature, numerous committee meetings are always featured at ASME Annual Meetings. During the week 17 Society Boards and committees were in session, the Boiler Code Committee met, there were 17 special research committee, 25 standardization committee, and 5 power-test-code meetings, while 44 committees of the professional divisions gathered at various times and places to discuss their problems.

RESEARCH COMMITTEES

In addition to the ASME Research Committee, fourteen of the Society's 17 special and joint research committees met during the Annual Meeting, as well as seven of their subcommittees. Better than 325 members and guests were in attendance for discussions on existing and future projects.

Nine technical sessions, listing 30 papers, were sponsored by several of these committees, cosponsorship being provided by a total of seven of the Professional Divisions. One session was cosponsored by the Pressure Vessel Research Committee of the Welding Research Council of The Engineering Foundation. It is interesting to note that five of the research sessions were held on Friday, the last day of the meeting. Excellent attendance disproved the commonly held notion that the last day should be avoided.

The ASME Research Committee meeting concentrated on the problem of developing new projects. An extensive schedule of "Research Conferences" was projected for 1949, in which personal and continuing contacts with the Executive Committees and Research Secretaries of the Professional Divisions, as well as with industrial groups, will be maintained. The objective of these conferences will be the determination of the boundaries of present knowledge in rather narrowly focused fields of interest and the requirements for new information in these fields which is of such nature that the Society can undertake projects leading to solutions. The Annual Meeting afforded the first opportunity to explore this plan with the Executive Committee of the Metals Engineering Division. A second meeting with a portion of this group is scheduled for the latter part of December.

The Research Committee on Properties of Gases and Gas Mixtures reviewed progress of the last six months in the development of plans for projects on thermal conductivity and viscosity of gases and gas mixtures at high temperatures and pressures. These are the first in a series of researches in this field, the ultimate cost of which is estimated at $1,000,000 over a ten-year period. This will be by far the largest research program ever undertaken by the Society.

The Research Committee on Lubrication reviewed a report submitted by Dr. R. V. Kleinschmidt describing progress of the project on pressure-viscosity relationships of lubricants sponsored by the committee at Harvard University. A number of companies in several industries contributed $26,000 in 1948 toward its support, and The Engineering Foundation made a grant of $3000, effective in the fiscal year starting Oct. 1, 1948.

Of particular interest in the meeting of the Research Committee on Fluid Meters was the first progress report on coefficients of discharge of eccentric and segmental orifices which is being undertaken for the committee by the Research Foundation of The Ohio State University. In 1948, industry contributed $5000 for this project. A similar amount will be forthcoming in 1949 to permit completion of the job. In addition, a joint subcommittee of the Fluid Meters Committee and the American Gas Association met for the second time to formulate further a project on factors affecting orifice performance, such as pipe roughness, meter fittings, and valve types. The gas-transmission industry is providing excellent co-operation in its development and every indication points to the fact that funds ($8000 to $10,000 for the first year) will be readily available.

The Research Committee on High-Temperature Steam Generation (formerly Critical-Pressure Steam Boilers) further crystallized its plans for a research program on factors involved in the generation of steam at temperatures considerably higher than those in present practice. The plan and budget will be completed in the next few months, at which time an announcement will be made.

The Research Committee on Plastic Flow of Metals reviewed progress to date and plans for continuing work at the Massachusetts Institute of Technology on determining stress patterns in a rolled bar during actual rolling operations for various metals and rolling sequences. The first progress report, entitled "Contact Stresses in the Rolling of Metals—I," by C. W. MacGregor and R. B. Palme, was published in the *Journal of Applied Mechanics*, September, 1948. Operating budget for the committee's projects this year is $9000, toward which The Engineering Foundation has granted $3500. Industry has been asked to supply the balance as it did last year.

In addition to the foregoing, the following research committees also met: Automatic Regulation Theory; Boiler Feedwater Studies; Condenser Tubes; Cutting Fluids; Effect of Temperature on the Properties of Metals; Furnace Performance Factors; Internal-Combustion Engines; Metal Cutting Data and Bibliography; and Strength of Vessels Under External Pressures.

INSPECTION TRIPS

COLGATE-PALMOLIVE-PEET COMPANY

On Monday, November 29, the Colgate-Palmolive-Peet Company was host to a group of ASME members and guests at their manufacturing facilities in Jersey City, N. J. The visitors saw the company's many soaps, soap products, and detergents being produced. Extensive facilities for storing and handling oils as well as the many unique wrapping and packaging machines were inspected.

WESTERN ELECTRIC COMPANY

ASME visitors were welcomed by the Western Electric Company's, Kearny, N. J., plant, on Tuesday morning, November 30. They were given an opportunity to see telephone relays being manufactured on a mass basis. The wire-drawing plant, where wire of all sizes is drawn for use in telephone apparatus, was also inspected. Included was a trip to the cable plant where various types of telephone cables are manufactured.

AMERICAN AIRLINES

American Airlines welcomed ASME members and guests on Tuesday afternoon at La Guardia Airport. Inspection groups visited various units of this airline including engine and overhaul departments, machine shops, sheet-metal department, propeller headquarters, and the hangars. Sightseeing flights of approximately 40 minutes' duration were also on the program.

COLUMBIA UNIVERSITY CYCLOTRON

On Wednesday morning, December 1, ASME members and guests were given the opportunity to see firsthand the large cyclotron at Columbia University Laboratory located on the Nevis estate, Irvington, N. Y. This cyclotron, when finally completed, is expected to be the most powerful one in operation in so far as energy exhilaration of particles is concerned. Its 2000-ton magnets were seen in operation by the visitors.

ESSO RESEARCH CENTER

The Esso Standard Oil Company extended its hospitality to ASME visitors on Wednesday afternoon. The company's new modern Research Center at Linden, N. J., was host to a group who saw petroleum research at work and observed firsthand the importance of such activities in the development of gasoline lubricants, fuel oils, and other petroleum products.

"GRIPSHOLM," SWEDISH-AMERICAN LINE

An inspection of the *Gripsholm*, famous transatlantic motor-ship, was afforded ASME visitors, members, and guests, on Thursday morning, December 2. The visitors saw the large Burmeister and Wain Diesel engines that power this twin-screw liner as well as the ship's elaborate appointments, such as the dining saloons, ballroom, music room, and swimming pool.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

The operating rooms and engineering and equipment rooms of the American Telephone and Telegraph Company, in New York, world's largest long-distance telephone center, were visited on Thursday afternoon by an ASME group.

In addition, on Thursday, special arrangements were made for ASME members and guests to visit the New York Naval Shipyard in Brooklyn, N. Y., and the Jacob Ruppert Brewery in New York.

REUNIONS

With so many mechanical engineers in town for the Annual Meeting, eight engineering schools took advantage of the situation by holding reunions on Thursday, Dec. 2, 1948.

The Cornell group met at the Cornell Club at a special meeting sponsored by the Cornell Society of Engineers. More than 90 of the engineering alumni heard T. P. Wright, vice-president of the University, speak on "The Role of the University in Research."

More than 60 of the Georgia Institute of Technology alumni met at the Princeton Club to hear Blake R. Van Leer, president of the Institute, report informally on progress being made. Following a question-and-answer period, a sound motion picture in color was shown of campus scenes and student activity.

The Harvard University group met at the Harvard Club for a social hour and dinner at which Leonard M. Fletcher of the Caterpillar Tractor Company, Peoria, Ill., spoke. Eighty alumni were present.

Other reunions were held by the New York University, Rensselaer Polytechnic Institute, Stevens Institute of Technology, and Worcester Polytechnic Institute, and were well attended. The University of Michigan group held a luncheon meeting at the Engineers' Club.

NATIONAL POWER SHOW

This year the Eighteenth National Exposition of Power and Mechanical Engineering again was held at Grand Central Palace, New York, N. Y., simultaneously with the ASME Annual Meeting.

The exposition, which consisted of approximately 400 exhibits, included the latest equipment covering every phase of power production, distribution, and application, from the treatment and combustion of fuels to the ultimate applications of heat and power at the processing unit or production machine. Many types of auxiliary and intermediate equipment, as well as those especially designed for the servicing and maintenance of power plants, were shown.

Exhibits ranged from packaged steam generators of 10 to 100 hp or more up to apparatus and equipment of the largest sizes made for superpower plants.

Specifically, the major categories were composed of the following groups of exhibits: Heat and power production, which included boilers, turbines, stokers, burners, blowers and exhaust fans, boiler tubes, heat exchangers, feed pumps, refractory and insulation materials, packaged steam boilers, steam-turbine pumps and compressors, and Diesel engines; means of distribution, such as piping, valves, and remote and automatic valve-operating apparatus; auxiliary units, including proportionate feeding systems, automatic alarms, cutoffs, and other safety appliances, air-filtering and smoke-precipitation apparatus, and liquid level controls; instruments such as gages, flowmeters, thermometers, and automatic recording and control apparatus of many kinds; machinery which included variable-speed transmissions, pulleys, chain drives, clutches, couplings, and the like; materials-handling equipment; engineering materials; and machines and tools.

COMMITTEE IN CHARGE

Meetings of The American Society of Mechanical Engineers come under the general supervision of the Committee on Meetings and Program. The technical program is provided by the Society's professional divisions and technical committees. Other features are planned and supervised by committees organized within the Metropolitan Section. In grateful acknowledgment of the many committees whose efforts contributed so substantially to the success of the 1948 Annual Meeting their personnel is listed in what follows:

Meetings Committee: Paul W. Thompson, chairman, Glenn B. Warren, Wm. H. Kushnick, Jos. W. Barker, and Allen W. Thorson, with Henry J. Scagnelli and Arthur J. Hughes as junior advisers.

Board on Honors: James M. Todd, chairman, Lewis F. Moody, Charles M. Allen, Clarke Freeman, Ely C. Hutchinson, and Paul E. Holden.

Committee on Medals: James M. Todd, chairman, Fred M. Feiker, Ernest L. Hopping, Lewis F. Moody, Charles T. Ripley, Charles M. Allen, Nevin E. Funk, Warner Seely, Blake R. Van Leer, Joseph B. Ennis, Clarke Freeman, Benjamin P. Graves, Harry R. Westcott, Tomlinson Fort, Ely C. Hutchinson, Morrough P. O'Brien, Robert M. Van Duzer, Jr., L. M. K. Boelter, Paul E. Holden, R. J. S. Pigott, and Ralph E. Turner.

Annual Dinner Committee: G. J. Nicastro, chairman, R. W. Flynn, vice-chairman, C. F. Beckwith, Walter Betts, and J. T. Costigan.

Committee on Inspection Trips: R. W. Flynn, chairman, W. L. Betts, G. E. Hagemann, and J. J. Moro-Lin.

Committee on Student Aides: Honorary chairmen, Metropolitan Section, Edward A. Bogusz, George A. Guerdon, George E. Peterson, Austin H. Church, Wm. A. Hadley, W. K. Wernick, and Gene S. Wood, professional divisions.

Committee on Women's Activities: Mrs. C. Higbie Young, honorary chairman, Mrs. H. R. Kessler, general chairman, Mrs. J. H. Hochuli, general vice-chairman, Mrs. F. M. Farmer, Mrs. T. A. Burdick, Mrs. B. E. Toben, registration; Mrs. G. W. Nigh and Mrs. Harold Erb, annual luncheon; Mrs. F. M. Farmer, Mrs. Charles Gladden, Mrs. T. A. Burdick, Monday tea; Mrs. Crosby Field, Mrs. E. A. Lundstrom, Mrs. Wm. L. Iliff, Mrs. Norman Dahl, activities.

ASME HONORS ENGINEERS

Biographies of Recipients of Honorary Membership and Awards at the 1948 ASME Annual Meeting

EVERY year The American Society of Mechanical Engineers honors distinguished members of the engineering profession by the presentation of certificates of honorary membership and the prizes and awards that have been instituted from time to time during the course of the Society's existence. The bestowal of these certificates, prizes, and awards is a colorful feature of the ASME Annual Dinner where the attendance this year exceeded 1400 persons. A description of the dinner and a list of the recipients of honorary-membership certificates, prizes, and awards will be found on pages 65–67 of this issue. In the following pages brief biographies are presented so that members of the Society may know what manner of men they have honored, and how signally they have honored their Society by recognizing outstanding and specific achievements.

HONORARY MEMBERS

CARL FRANKLIN BRAUN

Carl Franklin Braun, president of C. F. Braun and Company, Alhambra, Calif., a native Californian, was born at Oakland in 1884. He was graduated from Stanford University in 1907 with an ME degree.

Many years ago Mr. Braun fostered research work to determine coefficients of heat transfer for heat exchangers and on the basis of that, has developed a big business in manufacturing heat exchangers for the oil industry. He has done much to raise the standards of his profession and to establish the engineer in a high place among businessmen.

From the small factory which was built in San Francisco in 1910 the company was able to design and build equipment for ships, feedwater heaters, evaporators, vacuum pumps, and filters during World War I. In 1922 the company moved from San Francisco to Alhambra, a suburb of Los Angeles. Steady growth from a modest start has now carried the company to a top position in the field and World War II found it well-prepared to make a war effort that called heavily on the oil industry. A large part of the total production of aviation fuel and synthetic rubber was processed in plants and apparatus built by C. F. Braun and Company.

The factory is perhaps the largest and certainly the finest of its kind. The factory buildings and offices are all planned and tooled for top efficiency and for the comfort and high morale of the men.

LYMAN JAMES BRIGGS

Lyman James Briggs, director emeritus of the Bureau of Standards, Washington, D. C., was born in Assyria, Mich., on May 7, 1874. He received a BS degree from Michigan State College in 1893; an MS from the University of Michigan in 1895; and in the fall of 1895 he entered Johns Hopkins to continue his work in physics. Following the discovery of x-rays by Roentgen in the same year, he conducted the first x-ray studies at Johns Hopkins. He received his PhD from that university in 1901.

Few scientists have had careers so valuable to the U. S. both in its civilian functions and its military activities as Dr. Briggs who has completed 49 years of service in the technical work of the Government. During the last 12 of those years, while still carrying on active scientific research, he was the highly successful administrator of the National Bureau of Standards. The growth of the Bureau as a center of scientific attainment attests to his leadership and inspiration.

He has made significant contributions to the successful prosecution of both world wars. During the first he was authorized by President Woodrow Wilson to carry on special researches for the Navy. From this work came the development of a stable zenith instrument which facilitated accuracy in firing the Navy's big guns. He also worked out a new method of measuring the acceleration due to gravity at sea.

In the period between the wars, Dr. Briggs made important contributions to aeronautics. With Dr. Paul R. Heyl he invented the earth inductor compass, an instrument which overcame many perplexing difficulties in airplane navigation. This work won for the co-inventors the Magellan Medal, an American Philosophical Society award.

In 1939 he was appointed by President Roosevelt chairman of the original Uranium Committee. As a result of this work he is closely identified with the early work which led to the production of the atomic bomb and personally conducted much of the initial research.

For more than eight years he has been chairman of the research committee of the National Geographical Society and has helped to formulate the research programs for its worldwide expeditions.

Dr. Briggs has been honored by many educational and scientific institutions at home and abroad. He has been the author of many books and has contributed articles which have vastly enriched the store of scientific literature.

OSCAR ADOLPH LEUTWILER

Oscar Adolph Leutwiler, professor emeritus of mechanical-engineering design and head of the department of mechanical engineering of the University of Illinois, Urbana, Ill., since 1945, was born in 1877 in Highland, Ill.

He was educated at the University of Illinois and was graduated in 1899 with a BS in ME; in 1900 he received an ME degree.

From 1901 to 1903 he was an instructor in the department of mechanical engineering at Lehigh University. Then he returned to the University of Illinois as assistant professor in mechanical design, to start a long and rich experience in the field of engineering education. Professor Leutwiler has added much to the literature in the field of machine design and his texts are widely used all over the world. In 1915 he became a professor and in 1921 was made professor of mechanical-engineering design. Then in 1934 he was appointed head of the department of mechanical engineering.

GEORGE ICHABOD ROCKWOOD

George Ichabod Rockwood, formerly president, treasurer and owner of the Rockwood Sprinkler Company, Worcester, Mass., was born in 1868, in Boston, Mass. In 1892, before the advent of the steam turbine, Mr. Rockwood as draftsman and designer for the Wheelock Engineering Company, was co-

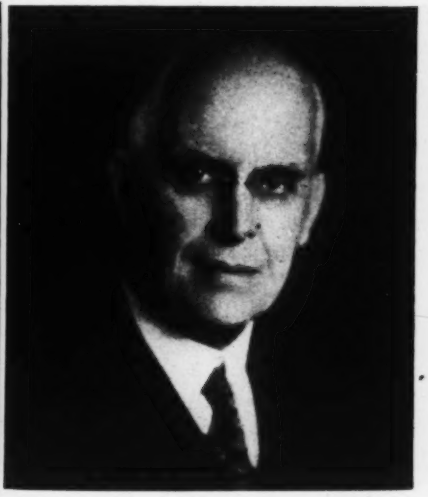
Made Honorary Members of the ASME

CARL FRANKLIN BRAUN
Honorary Membership

LYMAN JAMES BRIGGS
Honorary Membership

OSCAR ADOLPH LEUTWILER
Honorary Membership

JAMES WENTWORTH PARKER
Honorary Membership



GEORGE ICHABOD ROCKWOOD
Honorary Membership

author of a paper "Two Cylinders Versus Multi-Cylinder Engines" contributed to ASME which tended to show the results of tests of a triple-expansion Wheelock Engine run first with and then without its intermediate cylinder. Its design had been specially modified, when it was purchased, to settle the theoretical view held by Mr. Rockwood that intermediate cylinders of multicylinder mill engines were valueless. The article was in direct conflict with the settled view of all admitted authorities on the steam engine of the time. The tests tended to confirm Mr. Rockwood's view.

In 1894 he designed and supervised the erection of a steam plant and building and in the course of this work he invented and designed a new form of high-pressure steam-pipe flanged joint, which was the first instance of the use of the Rockwood flange.

From 1907 to 1909 he was professor of steam engineering and thermodynamics at Worcester Polytechnic Institute; in 1915 he became life trustee; and in 1939 president ad interim.

Mr. Rockwood formed the Rockwood Sprinkler Company, with offices throughout the United States and Canada, to exploit his patents on automatic-sprinkler apparatus for fire protection. He served the company as president, treasurer, and mechanical engineer. His sprinkler apparatus were approved by Associated Factory Mutual Fire Insurance Companies and the National Board of Fire Underwriters.

During World War II, in addition to the ordinary volume of business, the company manufactured tons of sheet steel into "Mark III" booster casings for high-explosive shells, besides developing other accepted ammunition components for the U. S. Ordnance Department.

When nearly eighty years old, he invented and produced a practical and efficient hospital patient-lifting apparatus, a much-needed and long-wished-for device, the only one in use today.

Mr. Rockwood became a member of ASME in 1891 and was elected to Fellow in 1936. He was active in Society affairs for many years and was manager, 1903–1906; vice-president, 1924–1925. In 1923 he provided a gold medal known as the Holley Medal and gave $6000 as an endowment for the medal.

JAMES WENTWORTH PARKER

James Wentworth Parker, president, The Detroit Edison Company, Detroit, Mich., has served the Society in many capacities. He was ASME manager from 1935–1938; vice-president, 1938–1940 and president in 1942. He was elected Fellow in 1946. Mr. Parker was born in 1886 in Auburn, N. Y. He attended Cornell University and was graduated in 1908 with the degree of ME.

After graduation Mr. Parker served an apprenticeship with the De Kalb Power and Light Company, De Kalb, Ill., and later with the Vincennes Street Railway Company, Vincennes, Ind. In 1910 he entered the employ of The Detroit Edison Company as boiler-room engineer. He was the first technically trained man to be assigned such duties in the company.

At the time the company had only one power plant, the Delray plant, in which there had just been installed the first of several 2365-hp boilers. Important information concerning the practicability and economic advantages of the then "very large boilers" was determined and Mr. Parker presented a paper on the subject before ASME which attracted interest and was a significant contribution to engineering literature.

In 1913 he became chief assistant engineer of power plants and he took an active part in the design of the company's second power plant, the Connors Creek Plant, which went into operation in 1914. Then in 1917, while he was engineer assistant to the vice-president, he was responsible for the design of the Marysville Plant which went into operation in 1922. During his twenty years as chief engineer the company's fourth power plant, the Trenton Channel Plant was built; other plants were rehabilitated; others were completely reconstructed.

During World War I Mr. Parker was granted a leave of absence from the company and served in the Nitrate Division of the Ordnance Department of the U. S. Army as a consulting mechanical engineer and head of the Division's Inspection Section. In World War II the War Production Board and War Manpower Commission appointed him consultant on certain engineering and technical problems.

Mr. Parker played a major role in the establishment of the Engineering Society of Detroit. The success of the organization is predicated on the motivating idea that it was not merely to be a social gathering place or simply a place to discuss engineering problems, but a point from which engineers could take a greater interest and a more active part in civic problems, particularly those confronting their own communities.

Mr. Parker has maintained a keen interest in engineering education, both at his alma mater and in the Engineers' Council for Professional Development, which is reflected in his active participation.

In October, 1947, he was appointed chairman of the Industry Advisory Group of the U. S. Atomic Energy Commission.

In 1935 Mr. Parker was awarded the honorary degree of MS by the Detroit Institute of Technology, and in 1942, the degree of Doctor of Engineering by Stevens Institute of Technology.

JOHN FRITZ MEDAL 1948

Theodor von Kármán, noted creative research engineer, mathematician, scientist, teacher, and research director, was born in Budapest, Hungary, May 11, 1881. He studied at the Budapest Royal Technical University and in 1902 received an ME degree. After a year of military service he taught for a year and then became a research engineer at Ganz and Company, Budapest.

In 1908 The University of Göttingen, Germany, awarded him a PhD and he remained there as a lecturer until 1912. He then was made professor of aeronautics and director of the newly established Aeronautical Institute of the University of Aachen.

Dr. von Kármán visited the United States under the auspices of the Guggenheim Fund for the Promotion of Aeronautics, in 1926, lecturing at many universities and research institutions. In 1930 he became director of the Guggenheim Laboratory at the California Institute of Technology and adviser to the Guggenheim Airship Institute.

He has served as chairman of the advisory board to the commanding general of the AAF since 1944. He has made important contributions to the Ordnance Department in his memorandums on the possibilities of supersonic wind tunnels in ballistic research and the development of long-range rockets. He has been a member of the Scientific Advisory Committee of the Ballistic Research Laboratory, Aberdeen, Md., since 1940 and is currently, chairman of the Scientific Advisory Board to the Chief of the American Air Force.

Dr. von Kármán has been a member of the ASME since 1931. He was awarded the ASME Gold Medal in 1941. Many universities have conferred upon him honorary degrees and professional societies have honored him with special membership. The United States Government awarded him the Medal of Merit in 1946.

He has greatly enriched the field of scientific literature with papers covering a variety of technical subjects and he has done much to promote international co-operation among engineer and scientists.

RECIPIENTS OF MEDALS AND AWARDS

ASME MEDAL 1948

Frederick George Keyes, physical chemist, distinguished scientist and mathematician, was born in Kingston, Ontario, Can., June 24, 1885. He was educated in the United States and in 1906 was graduated from Rhode Island State College with a BS degree. He received his MS from Brown University in 1907, a PhD in 1909.

While working for his master's degree he was an assistant in chemistry at Brown University and an instructor during the period spent in acquiring his PhD. In 1909 he was a Grand Army of the Republic research fellow; from 1910 to 1913 he was a research associate in physical chemistry at M.I.T. For the next three years he was chief engineer of Cooper-Hewitt Electric Company, and in 1916 he resumed association with M.I.T. as an associate professor in physical-chemistry research; then in 1920 he was made director of the research laboratory in physical chemistry. During World War I he was commissioned captain in the U. S. Army. His work as director of the Science and Control Laboratory, AEF, at Puteaux, France, earned for him a citation by the commander in chief, AEF, June, 1919.

He was awarded the Theodore Williams Richards Medal by the Northeastern Section of the American Chemical Society, 1942. He holds membership in many educational and scientific societies and is the author of numerous contributions in the field of thermodynamic properties of matter, kinetic theory

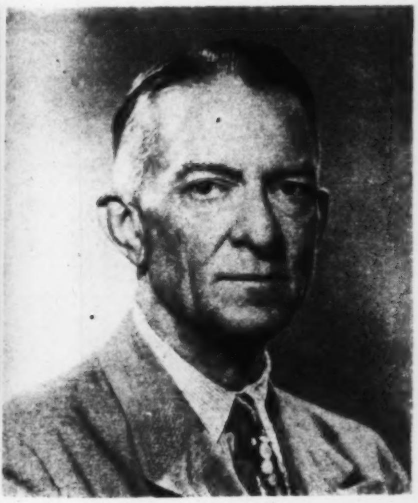
Recipients of Medals and Awards

THEODOR VON KÁRMÁN

John Fritz Medal

FREDERICK GEORGE KEYES

ASME Medal



REGINALD EVERETT GILLMOR

Melville Medal

EDWARD SMITH COLE

Worcester Reed Warner Medal

EDWIN HERBERT LAND

Holley Medal

of matter, and applications of thermodynamics to chemical-equilibria problems.

HOLLEY MEDAL

Edwin Herbert Land, president of the Polaroid Corporation, Cambridge, Mass., was born in 1909 at Bridgeport, Conn. Mr. Land won world recognition for his work in the science of polarized-light optics as the inventor of Polaroid and the self-developing camera which delivers negatives and finished prints in less than a minute after exposure.

He is a graduate of Harvard University; Tufts College conferred on him the degree of doctor of science in 1947. During his college years he began the development of means for polarization of light. He organized the Polaroid Corporation in Cambridge, Mass., 1937.

During World War II he conducted research leading to the development of new weapons and war materials, including plastic optical lenses for devices for seeing at night, new types of lightweight stereoscopic rangefinders, and an infinity optical ring sight used in antiaircraft guns and bazookas. He also served as a consultant on guided missiles.

He is the recipient of the Hood Medal of the Royal Photographic Society, the Cresson Medal of The Franklin Institute, the Scott Medal of Philadelphia City Trusts, and Modern Pioneer Award of the National Association of Manufacturers.

WORCESTER REED WARNER MEDAL

Edward Smith Cole, hydraulic engineer, was born in Washington, D. C., on Dec. 29, 1871. He attended the University of Illinois for two years and then transferred to Sibley College, Cornell University. He was graduated in 1894 with an ME degree. Subsequent to his graduation he worked as

Recipients of Medals and Awards

WALTER GUIDO VINCENTI
Pi Tau Sigma Gold Medal Award

HUNT DAVIS
Junior Award

THOMAS LAIRD DINSMORE
Postgraduate Student Award

EARLE DUANE STEWART
Charles T. Main Award

LEROY WILLIAM LEDGERWOOD, JR.
Undergraduate Student Award

an assistant to his father in the design and construction of city waterworks plants. In 1896 he proposed and developed an instrument for the measurement of flow in water mains under pressure based on the Pitot tube and named it the pitometer in honor of Henri Pitot.

This instrument was first used in Terre Haute, Ind., in 1897 in a water-waste survey of the city distribution system. This was followed by surveys in other cities. In 1904 Mr. Cole organized the Pitometer Company in association with his father and continued to make pitometer surveys in many cities in the U. S. The British Pitometer Company, Ltd., was organized in London, England, and Kilmarnock, Scotland, in 1920 by Mr. Cole and the firm of Glenfield, Kennedy, Ltd. Between 1920 and 1927 he developed the pitometer log with E. Robert Howland of London and in 1927 organized the Pitometer Log Corporation of New York, N. Y., to handle the application of the pitometer for use on ships to measure speed and distance. In the second world war it was used extensively by the U. S. Navy and the British Admiralty on warships. In 1945 the Pitometer Log Corporation was awarded the Army-Navy E for excellence in production.

Mr. Cole has contributed greatly to the scientific literature pertinent to this work. He has been a Fellow of the ASME since 1941.

MELVILLE PRIZE FOR ORIGINAL WORK

Reginald Everett Gillmor, vice-chairman, National Securities Resource Board, Washington, D. C., was born on July 13, 1887, in Menominee, Wis. He was graduated from the U. S. Naval Academy in 1907. He served aboard several capital ships of the fleet, principally on the U. S. S. *Delaware*, the first dreadnaught used by the U. S. Navy.

He resigned from the Navy in 1912 to join the Sperry Gyroscope Company and went to London where he established the European office of the company and organized a subsidiary English company, the Sperry Gyroscope Company, Ltd., which he served as managing director. In 1917 he rejoined the Navy, remaining in London as flag secretary to Admiral William S. Sims, Commander in Chief of the U. S. Naval Forces in European waters at that time. He rejoined the Sperry Company in 1918 to help organize the company on a war basis and served successively as Washington, D. C., representative, sales manager, vice-president, and president from 1932 to 1946. Then he relinquished the presidency of the Sperry Gyroscope Company to become the vice-president of the parent company, the Sperry Corporation. For the past year he has been loaned by his corporation to the State Department assigned to the directorship of the Industry Division of the American Mission for Aid to Greece.

JUNIOR AWARD

HUNT DAVIS, Jun. ASME, was born in New York, N. Y., in 1920. He received a BS degree from Haverford College in 1941. While at Haverford he was given an AIEE Student Award for a paper describing the development of an original magnetostriction stress gage. After graduation he was employed by the Westinghouse Research Laboratories and worked on the development of high-speed centrifuges, dynamic balancing machines, and lubrication studies. Evening courses at the University of Pittsburgh brought an MS in ME in 1944. In 1945 he was employed in the research and development department of the Elliott Company and in 1946 was made division engineer in charge of the aerodynamic division. This work embraces the theoretical analyses and experimental developments in connection with centrifugal and axial-flow compressors for gas turbines, turbosuperchargers, and industrial service. He is chairman of the ASME Westmoreland County Subsection, a division of the ASME Pittsburgh Section. He is a member of Phi Beta Kappa and a member of the Institute of the Aeronautical Sciences.

PI TAU SIGMA GOLD MEDAL AWARD, 1948

WALTER GUIDO VINCENTI was born in Baltimore, Md., April 20, 1917. He attended Stanford University from 1934 to 1940 and upon graduation was awarded the degree of BA (in engineering) in 1938, and the degree of engineer (in mechanical engineering, aeronautics option) in 1940. He has been associated with the National Advisory Committee for Aeronautics at the Ames Aeronautical Laboratory, Moffett Field, Calif., since 1940. His graduate work at Stanford was done as an Abraham Rosenberg Research Fellow and as such he carried out an experimental investigation of the aerodynamics of oscillating airfoils. He was elected to the following societies: Phi Beta Kappa, Sigma Xi, and Tau Beta Pi. He served as a lecturer in mechanical engineering at Stanford for the academic year 1946–1947.

The work Mr. Vincenti has been doing at Ames Aeronautical Laboratory has been in the fields of wind-tunnel design, tunnel-wall interference at subsonic speeds, and general supersonic aerodynamics. From 1945 to 1948 he was head of the Ames 1 × 3-ft supersonic wind-tunnel section supervising the development of research techniques and the conduct of fundamental research programs at supersonic speeds. He is at present employed at the Ames Laboratory as a research specialist and consultant on individual problems in supersonic aerodynamics, and has been, since 1947, a member of the NACA's Subcommittee on Internal Flow.

CHARLES T. MAIN AWARD

EARLE DUANE STEWART was born Dec. 30, 1922, in Brookville, Pa., where he attended public school. At the time of his graduation from high school in 1939, Mr. Stewart was awarded a free scholarship by the International Correspondence Schools, and in 1940 he completed the school's course in mechanical drafting.

In February, 1941, Mr. Stewart was employed as a junior draftsman by the Westinghouse Electric Corporation, at which time he enrolled in the evening school of mechanical engineering, University of Pittsburgh. From May, 1942, until he entered the Army in January, 1944, he worked as plant draftsman at Carnegie-Illinois Steel's plant in Etna, Pa. After his military service, Mr. Stewart enrolled in the regular session at the University of Pittsburgh. The following year he was elected to student membership in the ASME, Sigma Tau, and Pi Tau Sigma. He was graduated from the University of Pittsburgh in June, 1948, with the degree of BS in mechanical engineering. He is presently employed as a mechanical engineer for the West Virginia Pulp and Paper Company.

POSTGRADUATE STUDENT AWARD

THOMAS LAIRD DINSMORE was born in Brooklyn, N. Y., July 24, 1925, and graduated from Poly Prep Country Day School in June, 1943, at which time he was accepted in the Navy V-12 program. The Navy then sent him to Hobart College and after his freshman year he was transferred to the University of Rochester. In February, 1946, he received a BS degree in ME and was also commissioned an ensign in the U. S. Naval Reserve. While at Rochester he was elected to the "Vectorians," an honorary engineering society. In September, 1946, he was accepted at Princeton University for graduate work in mechanical engineering, and also obtained an appointment as a teaching assistant. Prior to receiving his master's degree in June, 1948, he was elected to Sigma Xi. At present he is an instructor in mechanical engineering at Princeton University, and a junior member of the ASME.

UNDERGRADUATE STUDENT AWARD

LEROY WILLIAM LEDGERWOOD, JR., was born in Springfield, Mo., Oct. 9, 1920. He was graduated from Greenwood High School and was awarded a one-year scholarship to Southwestern Missouri State College, Springfield, Mo. He served almost two years with the U. S. Air Force. Upon his separation from the service he enrolled in Oklahoma A&M College to complete his studies. While at Oklahoma he received two undergraduate scholarships. He is a student member of ASME, member of Pi Tau Sigma, Sigma Tau, Pi Mu Epsilon, and the student branch of the Oklahoma Society of Professional Engineers.

ASME 1948 ANNUAL MEETING PREPRINTS

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[1] Digest published in Mechanical Engineering, November, 1948, see pp. 912 to 921.

[2] Digest published in Mechanical Engineering, December, 1948, see pp. 1012 to 1021.

[3] Digest published in this issue, see pp. 36 to 50.

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COMMENTS ON PAPERS

Including Letters From Readers on Miscellaneous Subjects

The Gas Turbine With a Waste-Heat Boiler

COMMENT BY J. GOLDSBURY[1]

The utilization of part of the heat in the exhaust from a gas turbine for generation of steam deserves consideration in cases where there are demands for both steam and power.

Of course, an investigation would be made as to the relative economics of a gas-turbine power plant with waste-heat boiler as compared with a conventional steam-turbine power plant. If the gas-turbine power plant is selected, the two alternatives described in this paper[2] for providing flexibility in relative steam and power outputs should be compared. The arrangement using an auxiliary burner seems to have several important advantages, as follows:

1 It seems probable that the auxiliary burner and fuel-supply system will be less expensive than an exhaust-line valve and its operating mechanism. A valve with 1950 sq in. passage area and designed for over 800 F operating temperature would be costly.

2 Average gas-turbine blade temperatures will be lower for the alternative using an auxiliary burner.

3 With an auxiliary burner the steam and power demands would be entirely independent.

It should be noted that additional primary air may not be needed for the auxiliary burner.

On the other hand, the classification of the waste-heat boiler as an unfired pressure vessel when the turbine exhaust valve is used will be both a technical and a practical advantage.

COMMENT BY J. R. HASKIN, JR.[3]

To date, considerable literature has appeared on the use of gas turbines in central-station, marine, and locomotive installations, and little information has been published on their use in industrial power plants. This seems strange in view of the fact that the number of possible gas-turbine applications in power plants, furnishing both steam and power for industrial use, appears to be vastly greater than the number of possible gas-turbine installations in the combined central-station, marine, and locomotive fields. Therefore, it is gratifying to have a paper on gas turbines suitable for industrial-power-plant service presented at this time, and the author is to be complimented for his contribution to the literature.

The author has suggested two methods of obtaining a steam generation greater than that which would result if the turbine exhaust gases were not reheated prior to their passage through the boiler-tube bank, or if their flow from the turbine to the boiler were uncontrolled. The use of an "auxiliary burner" has been suggested in at least one paper presented heretofore, but the proposed throttling of the turbine exhaust has not, to the best of this commentator's knowledge, been considered previously, and is a valuable contribution to the literature.

Data have been presented in the paper in economic justification of a waste-heat boiler for recovering heat from the turbine exhaust. While these data have justified the installation of a waste-heat boiler, they have not justified the use of a gas turbine with waste-heat boiler rather than a steam turbine in an industrial power plant. This writer has had the opportunity of making a large number of economic comparisons of such installations. These studies have shown that with the present capital requirements of the two types of plant, a steam-turbine plant, in some cases, offers greater economic advantages than a gas turbine and waste-heat boiler plant. When all power can be generated as a by-product of the steam demands, the gas turbine cannot compete with a back-pressure, or extracting and back-pressure, steam turbine when the fuel cost per million Btu is the same for both plants. Furthermore, the gas turbine cannot always compete with an extracting-condensing steam turbine when the fuel costs per million Btu are the same for both plants. In this case, the percentage of power which must be generated condensing is the controlling factor. Therefore, no decision can be reached as to the advisability of installing a gas turbine and waste-heat boiler rather than a steam turbine, or vice versa, until an economic comparison has been made of the two types of turbine for each installation under consideration. An earlier paper[4] presented data for use in making a preliminary estimate of the economics of the two types of plant for any proposed installation. If such an estimate shows that it might be advantageous to use a gas turbine and waste-heat boiler, a more elaborate and detailed study could be made after consultation with the turbine manufacturers.

The over-all thermal efficiency of a gas turbine depends primarily upon the amount of heat recovered from its exhaust. Considering any heat-transfer surfaces used for this purpose as an integral part of a gas-turbine unit, the thermal efficiency of the unit can be improved by the use of a regenerator, a waste-heat boiler, an economizer (feedwater heater), or any combination of these heat-transfer surfaces. In calculating the steam generation for various power loads and ambient temperatures, the author has assumed feedwater conditions of saturated liquid at 0 psig. This is just another way of saying that the feedwater temperature is 212 F. In actual practice, if no feedwater heating is used, feedwater temperatures are usually below 212 F. Therefore, it is assumed that the author considers the heating of feedwater as having been accomplished prior to its admission into the boiler. Since the author makes no mention of an economizer recovering heat from the turbine exhaust gases after they have passed through the waste-heat boiler, it assumed that he considers feedwater heating to be done by equipment other than such an economizer. Numerous studies by this commentator have shown that such an economizer can usually be justified. It is suggested that when making economic comparisons for proposed installations, the use of such an economizer should always be considered until proved economically unjustified.

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[1] General Electric Company, Lynn, Mass. Mem. ASME.

[2] "The Gas Turbine With a Waste-Heat Boiler," by G. R. Fusner, MECHANICAL ENGINEERING, vol. 70, June, 1948, pp. 515–518.

[3] St. Louis, Mo. Mem. ASME.

[4] "The Modern Gas Turbine in the Industrial Power Plant," by J. R. Haskin, Jr., MECHANICAL ENGINEERING, vol. 69, June, 1947, pp. 475–478.

When considering the use of an economizer, the question of stack-gas dew points usually arises. Owing to the large quantities of "cooling air" required, these temperatures are much lower than those encountered in steam power-plant stacks. For example, when burning a typical natural gas at the rate of 243.7×10^6 Btu per hr in a turbine having an inlet temperature of 1150 F, the turbine exhaust dew point is approximately 96 F when the ambient air is saturated at 70 F. Looking ahead to the time when pulverized coal is used as a fuel, burning a typical Illinois coal under the same conditions would give a dew point of approximately 76 F.

The writer has been an ardent gas-turbine enthusiast for several years, but he realizes that the gas turbine is not a cure-all for the industrial power engineer's problems. On the other hand, a properly engineered industrial gas-turbine power plant will, in a majority of cases, show greater economic advantages than an industrial steam-turbine power plant for the same service. The writer also realizes that the field of possible applications of gas turbines for industrial service is so broad that no one paper can hope to cover all of the subject. He therefore hopes that more engineers will explore this field and publish their findings.

Comment by K. J. Ray[5]

It will be noted that the steam production from the waste-heat boiler is subject to an infinite variety of combinations, depending upon turbine load, ambient temperature, and steam demand. In order to avoid constant supervision, which might prove to be a nuisance, some type of control is necessary; otherwise an additional direct-fired boiler would be required to compensate for the variation in steam production.

Apparently there is some disadvantage in control by throttling the turbine exhaust due to the higher average temperature and possibility of greater maintenance costs. The advantage lies in simplicity of the arrangement and elimination of auxiliary firing.

The advantage of auxiliary firing is that much higher gas temperatures to the boiler are obtainable, so that considerably more steam may be produced with a given size of boiler. This feature would favor higher operating pressures. In this connection, the addition of an economizer after the boiler would appear a logical step, since under these conditions the exit-gas temperature from the boiler is high enough to warrant one.

One interesting feature of the waste-heat-boiler application is that relatively high gas pressure drop may be used, that is, in the order of 0.5 to 1.0 psi. This will result in a relatively small boiler with large steaming capacity.

With reference to the actual construction of the waste-heat boiler, it may be noted that, although the service is different from that of the direct-fired boiler, it is customary to build waste-heat boilers in accordance with the ASME Power Boiler Code.

Comment by J. W. Blake[6]

Mr. Fusner's paper contains certain information which the writer feels is apt to give a wrong impression of what is available in the way of gas turbines as of this date. Sizing of associated equipment in connection with waste-heat recovery is also erroneous.

The author has indicated that the standard 3500 kw simple-gas turbine as available for sale from the General Electric Company at the present time could be obtained with an exhaust temperature of 820 F. Actually, the General Electric Company will not sell this unit for an exhaust temperature higher than 780 F. Their reason for such limitation is the lack of experience with materials used on the hot end of the unit.

In view of these limitations of inlet and exhaust temperatures, a large portion of Mr. Fusner's paper is really a dissertation on what could be done if these temperature limits could be raised. The waste-heat recovery equipment mentioned in his paper contains about one half enough surface in order to accomplish what he claims it will do as a waste-heat device. It probably would deliver the steam he states if it were used as a fuel-fired boiler.

In the present state, this particular turbine Mr. Fusner is discussing, will burn either oil or natural gas and it would certainly appear very uneconomical to use this type of fuel for additional steam generation except in those areas where natural gas is available. Additional steam would appear to be available at lowest cost if produced by coal.

Comment by S. F. Mumford[7]

The author of the paper has suggested the use of a waste-heat boiler to recover heat from the exhaust gas of the gas turbine. Combustion Engineering Company has designed and is building a piece of heat-recovery equipment, identified as a gas-turbine recuperator, more effectively to perform the same function. This recuperator will be installed with the first commercial application of a gas turbine to a public-utility plant.

The recuperator will heat feedwater for existing steam generators. Although the power of the turbine will be the same, 3500 kw, the operating conditions will vary slightly. In the paper, possible heat recovery has been based on 308,000 lb of exhaust gas per hour at 820 F with an ambient-air temperature of 80 F whereas 344,000 lb exhaust gas at 780 F with 80 F ambient temperature is the basis for the selection of the recuperator.

The recuperator consists of 76 elements of the extended surface type and has approximately 19,000 sq ft of total gas touched surface. It will be operated at approximately 600 psi. Our recuperator "effectiveness" while practically the same as the waste-heat boiler will absorb better than 55 per cent more heat from the exhaust gas than would a waste-heat boiler generating steam at 200 psi. Recovery would be 29 per cent greater than would be expected from a waste-heat boiler operating at 50 psi. The primary reason for the greater possible recovery is the more favorable temperature differential available.

It is anticipated that at the design condition 350,000 lb water per hr will be heated from 185 F to 295 F. This will reduce the temperature of the exhaust gas from 780 F to 325 F.

The approximate size of the recuperator, excluding supports and ductwork, will be 8 ft high × $14^{1}/_{2}$ ft wide × 18 ft long. The total box volume occupied by the unit, therefore, will be about 53 per cent as much as the waste-heat boiler described.

The use of this type recuperator permits considerably greater heat recovery than could be realized with a waste-heat boiler. Furthermore, by adding the heat recovered to the feedwater it is possible either to reduce the fuel consumption of the steam generators or, with the same fuel consumption, to increase the capacity of the steam generators.

Author's Closure

The question raised by Messrs. Goldsbury and Haskin, concerning the economic comparison between a gas turbine-waste-heat-boiler combination and a boiler-extraction steam-turbine combination is a good one. Calculations made by the author comparing a 400-psig 750 F steam turbine exhausting to 50 psig with the gas turbine - waste-heat-boiler combination showed the fuel economy of the steam turbine to be slightly better

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[5] Foster Wheeler Corporation, New York, N. Y.

[6] Assistant Superintendent of Generation, Oklahoma Gas and Electric Company, Oklahoma City, Oklahoma. Mem. ASME.

[7] Chief Engineer, Marine Department, Combustion Engineering Company, Inc., New York, N. Y. Jun. ASME.

However, only time will tell what the over-all operating costs will be on the gas turbine. Indications now are that they should be lower. Since no expensive high-pressure boiler is required, and the gas turbine needs only a small basementless building, its installed first cost should be lower.

In answer to Mr. G. W. Blake's comment, the author did not intend to give the impression that the performance calculations presented in this paper applied to any particular commercial gas turbine, and this distinction is made in the third paragraph of the paper. It is perhaps pertinent to state that the 40 F lower exhaust temperature of the actual unit is offset by about 10 per cent higher air flow than that assumed in the paper, so that the heat available in the gas-turbine exhaust is quite comparable in the two cases. Regarding the amount of boiler surface required, the mass flow of gas per unit free area that is contemplated is materially higher than usually encountered in steam boilers of this capacity. This results in high heat-transfer rates, and reduces the amount of surface required, naturally at some cost in increased pressure drop. The allowable pressure loss, which is related to the size and cost of the boiler, must be studied separately for each installation. For the pressure drops assumed, the amount of surface as stated in the paper has been checked by boiler manufacturers.

As Mr. Mumford points out, the application of using the heat in the exhaust gas of the gas turbine to heat boiler feedwater is a good one. However, it should be mentioned that this application is limited. This can only be used in stations where the boiler capacity is a limiting factor. In most stations there is plenty of boiler capacity, and the turbine is limiting.

G. R. FUSNER.[8]

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[8] Gas Turbine Engineering Division, General Electric Company, Schenectady, N. Y. Jun. ASME.

REVIEWS OF BOOKS

And Notes on Books Received in the Engineering Societies Library

People and Natural Resources

ROAD TO SURVIVAL; with introduction by Bernard M. Baruch. By William Vogt. William Sloane Associates, New York 19, N. Y., 1948. Cloth, $5^1/_4 \times 8^1/_4$, 335 pp., illus., $4.

REVIEWED BY JOHN P. FERRIS[1]

PERHAPS the greatest danger to us all—a greater one than atomic warfare—lies in our incomprehensible way of ignoring the plain fact that mankind must come to terms with the natural environment, and especially with the land. That is what this book is about.

Because Mr. Vogt's book may alert people, one can forgive some, but not all, of the author's disservices. The book spreads far and wide a great many misleading assertions that are not facts and omits vital facts. It implies that it is giving, but does not do so, a comprehensive handling of its vast and complex subject. The supreme value for human life which the book implies, but does not clearly postulate, is some "balance" in which man's place merely parallels that of other animals. This reviewer saw no evidence that the author envisages man's concerning himself ultimately to develop in full the uniquely human potentialities of which our civilizations have already developed the beginnings; nor to realize the high aspirations of the human spirit.

The book takes the position that the last two centuries' rapid increase in the world's population will continue except as it is stopped by food shortage, disease, war, or an all-out birth control crusade. The author urges such a crusade on a voluntary basis as a major objective of research and public policy.

A second conclusion is that food production cannot be increased to meet the food needs of future populations if its numbers approximate the figures now generally predicted—unless the present rapid destruction of soils is continued. He offers the conception of a "biotic potential" of each acre of land, varying for different lands, but not providing much stretch in what any one piece of land can be made to do without destroying it in a relatively short time. The author seems to counsel a greatly stepped-up effort to restore and conserve land; and yet his position is confused, for he bestows his praise mainly on rather mechanistic approaches to soil conservation which gives entirely too little emphasis to people and to the fact that our land resources are only a part of a complicated web in which other resources and many phases of our economy affect the net result.

Third, the book almost ignores the great effects of modern technology in agriculture and particularly in industry, in bringing about sustained production on farm and forest lands, as well as some striking actual accomplishments in teaming technology and human effort toward better land management in a better-balanced agricultural and industrial economy.

As to population trends, Vogt's neo-Malthusianism needs to be questioned. With the industrial revolution it is of course true that there came a spectacular increase of population; the most industrialized western countries, like England, Germany, and the United States, clearly showed this population spurt.

But a later phase of industrialization seems to bring with it a tendency toward slower population increase, stability, or even toward reduction. Economic motives appear to be at work; for instance, more and more people want to educate their children, and the economic burden on families is great in a complex society which presses for specialized education. In England the rate of population increase was dropping off before the beginning of this century; Sweden shows a similar trend, and so does the United States, in spite of immigration and a long period of economic expansion.

Apparently, the future populations of the nations are affected by other forces than food and the fear of its shortage.

There is a concise and illuminating discussion of the state of our knowledge about long-term population trends in an article by Rupert Vance: "Malthus and the Principle of Population," which appeared in the July 1948 number of *Foreign Affairs*. Vance believes that the bases for prediction are extremely uncertain. He says: "We have seen that overpopulation can set in motion certain social and economic forces which check it. . . . In our . . . lifetime we shall probably not know whether a permanent decline in population has set in for the advanced countries in western civilization;" and "Few students of the problem expect to arrive at a general law of population growth applicable to all peoples at all times."

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[1] Manager of Reservoir and Community Relations, TVA, Knoxville, Tenn. Mem. ASME.

This reviewer will not, however, quarrel with Vogt's insistence that in many parts of the world man must find and voluntarily apply effective means to limit population. It is tragic when, because of sheer numbers, he is doomed to a mean existence which simply cannot sustain a good life, except for a few who at any given moment hold favored land and other resources. It seems unlikely that our productive system could increase its output as fast as the world's population has been increasing since, say, 1776—unless we continue to consume irreplaceable resources, and especially soil, at a rate which leads surely to disaster.

Does the author really know what he is talking about when he postulates his "biotic potential" of land; when he tries to show that the earth's surface is not capable of producing enough food for the $2^{1}/_{2}$ billion or so people now living? A national authority on soils, Dr. Charles E. Kellogg, Chief of the Soil Survey of the United States Department of Agriculture, spoke to this point in a recent address before the American Farm Economic Association. For one thing, the world could, he estimated, have the additional output of something like 1,300,000,000 acres or its equivalent, once some serious technical and institutional problems are recognized and solved. The following quotations taken here and there from his talk are suggestive: ". . . potential new land and the increases . . possible on land now being farmed could give us food significantly beyond that needed for the estimated world population of 1960. . . Such estimates are very optimistic in one sense and probably still too low in another. They indicate what *could* be done with present knowledge *if* the political and economic barriers to effective soil use were somehow removed. At the moment, this 'if' may seem to call for miracles of education and statesmanship that few expect. . . . Yet even these estimates take no account of entirely new technology. . . . The tropics . . . (does not yet have) a soil science of its own, let alone a technology . . ." With respect to the probable future effects of science, Kellogg says, "These reckonings take no account of the real likelihood that science may soon know how to make at least simple foods like common sugar synthetically. . . . Modern science . . . (is increasing) our efficiency . . . at an accelerated rate. Will it not continue? Certainly."

Even a layman must marvel at Vogt's ignoring many commonly known things which dramatically influence the productivity of soils. One of these is the irrigation of now useless lands. More important, modified plants might be developed which would step up the effectiveness of photosynthesis; if man succeeded in this, there could be a great increase in the amounts of carbon, hydrogen, and oxygen from air and water which, through solar energy and life processes and limited quantities of soil minerals, plants would make into useable starches and sugars. These are, of course, foods for animals and men. Are scientists ready to say that an efficiency of some 3 per cent is all we are likely to get from plants? And what scientists support Vogt in writing off the vast reaches of the ocean as a setting for food production?

On millions of farms, industrial technology has been helping restore soils and increase output on a permanent basis. New tools in the hand of the farmer have been aiding. An ample supply of electrical energy, for instance, fosters dairying, a cover crop - livestock type of agriculture that helps rebuild and maintain soil. Some of the new machines for small farms facilitate the change from soil-destroying to soil-maintaining patterns. "Biotic potentials" depend on the extent to which we grow soil-destroying crops, like cotton, or soil-building crops like legume grasses which capture nitrogen from the air; hence they are affected by research, education, and public policies.

It is industrial technology that takes phosphate rock and makes it into a chemical that, when placed in phosphate-deficient soils, gives impetus to such agricultural changes as those mentioned herein. The nation has (in the Tennessee Valley) a "pilot plant" where fertilizer technology is being advanced, and the results tried experimentally on many thousands of farms in a region which had until recently been characterized by declining soil fertility. One of the goals and effects is to open the way for industry to carry the lessons learned into the nation's commercial life. TVA's experimental laboratories and electric furnaces at Muscle Shoals are supplying the concentrated phosphates for the pioneering venture in soil rebuilding. New markets are created for such products and private manufacturers are beginning to fill them, to their profit.

Obviously, industry is sometimes a constructive element in the ecological equation. There is a visible increase in man's understanding of what industry can do in using limited resources more shrewdly. Vogt is no doubt right that our modern industrial civilization, ***so far***, has speeded us along the road toward exhaustion of natural resources. Any such conclusion, however, blames on the industrial *process* what is basically caused by a high level of demand for and consumption of goods. We demand, for example, vast quantities of paper. Most has been had by stripping woodlands and moving on to the next; ***but not all***. There is sustained-yield production of pulpwood here and there along the southern coastal plain—a result of public and private research and private enterprise. America was short of capital (and patience) to finance long-range methods a century ago. But we have it now, and capital is beginning to be used for just this. No doubt production of pulpwood as a crop will before long become the *cheapest* way of getting paper, in addition to being the only way that makes sense for the long pull. The point is that industrial technology is, here and there, already changing in ways which bring it in line with a sound ecology; it is showing that Vogt's sweeping damnation of capitalist democracy's economics cannot be completely sustained even by the facts as they are, and much less if we take into account the visible prospects for improvement.

What farmers do with their lands is affected by many forces, and they have been under test for 15 years in a unified approach in the national proving ground in the Tennessee Valley. Over 50,000 farmers in the Valley and elsewhere have been in on the widespread practical testing of new forms of fertilizers in a concerted effort to reconstitute the Valley's agriculture in line with the requirements of permanence and greater productivity. Electric power, new farm machinery, new community organizations, and opportunities offered for nonfarm employment for rural people who want other kinds of employment in expending private industry—all these have played important parts.

In many cases, lands which a decade ago were thought "on the way out" are now largely restored and highly productive. On some widely occurring soils in the Tennessee Valley, fertility is now higher than in its pristine state, due to overcoming natural deficiencies of phosphates. Such results often occurred on soils which had deteriorated badly, because they had been robbed of phosphates through cropping and erosion. (This is a problem which is overtaking even some deep black prairie soils in the Midwest, which were formerly considered of inexhaustible fertility.)

In fact, improvement is so interwoven with changes in the total scene—advancing industrialization and increased per capita share of the national income, etc. —that they are difficult to isolate and measure. But Vogt has no excuse, other than perhaps lack of knowledge, for ignoring them.

These results are of course as much a human accomplishment as an agricultural achievement. If we want soil actually conserved, the main problem is people, —their motivations, the economic pressures under which they work, their knowledge, their ideas and aspirations. In seeking to manage resources better, our strategy should be centered on mobilizing ideas, abilities, energies, enthusiasms, and of course technical knowledge. More and more people need to acquire the "ecological outlook" and embody it in their own lives. Scientific and technical leadership needs to be provided, especially in danger areas of rising population and dwindling resources. Kellogg has pointed out the extreme importance of institutes of soil science in the tropics, as already indicated. Vogt himself says, "Arable land is as much a function of the farmer as of the farm." Yet all through the book he forgets people, except where he treats them as marching columns of population data.

This reviewer strongly disagrees with Vogt's unstated assumption that the problem of coming to terms with nature is just a problem of "biophysical balance," involving man's status as an animal. In the problem of better management of natural resources, our strategy, it is suggested, should be centered on mobilizing ideas, abilities, energies and enthusiasms. Some of the greatest contributions might never happen if their potential authors were never permitted to be born, among the "hordes" of peoples in crowded lands which Mr. Vogt wants to reduce! Perhaps we should lose a Mendel, for example.

Even at the risk of "wasting" some precious exhaustible coal, I feel sure it will be a good investment to burn some of it to keep the buildings warm in which our musicians and atomic scientists and teachers and poets and writers and engineers are working. Perhaps we should do this even though we have as yet no *assurance* that our scientists and engineers will, before the coal is gone, find other ways of getting the energy we need. And presumably man's physical existence is to some extent endangered because the population includes philosophers and artists who eat and wear clothes and who do not themselves raise food or restore forests; and because it includes research workers in liberal-arts universities or engineering colleges or law schools or state departments of public health or voluntary organizations to promote international co-operation. (The effects of the thinking of some of these latter people probably interfere with normal slaughter in war, which tends to keep down the population.) Shall we assume, as Mr. Vogt seems to, that man's problem in living on the planet boils down to mere survival? Or are there other values which each person as an individual is entitled to pursue? Perhaps society should gamble something of its physical security in pursuit of values which go beyond mere animal existence.

Incidentally, some intangible satisfactions—music and telephonic communication between people, for instance, —consume natural resources only to a negligible extent. Radio communications across the continent probably consume less resources in a year than did the forty-niners in their covered wagons who shot vast quantities of game in the six-months' trek.

Some parts of his book help make people aware of the fact that they are forever dependent on how they use the "building blocks" of nature, and are constructive. For instance: "We discuss national income as though it were somehow different from national outgo. We write books to discuss whether or not we can 'afford' to conserve soil. We extract oil, and iron ore and fine timber, and canvasbacks, and call it *production*. . . . The money evaluation of the exploitative lumberman, farmer, stockman, trapper, and industrialist—of our growing population—must be subordinated to a biophysical evaluation."

It is likewise constructive in pointing out that no one-sided approach to resources conservation will do, involving only the physical job of farming, forestry, mining, processing of nature's material in industry, etc. We must, Vogt says, greatly step up the use of the social sciences—psychology, economics, sociology, semantics, anthropology; these are, as Vogt puts it" . . . the radar that can avert disastrous crashes." He shows how great is the part played by politics and implies that the ship will go on the reefs unless the radar signals are heeded by those at the political helm.

In laying out our real "road to survival" we must look to our best thinkers in many fields. This book does not give a really usable chart. It is based on a hodgepodge of valid and important insights, bad reasoning, good reasoning, pure prejudices, facts, and statements which pretend to be facts but actually fly in the face of knowledge of the technicians in many disciplines who really know their facts. Essential facts and experiences have been ignored. Many of the interpretations of science and technology are invalid or unimaginative. Engineers have a nose for such shortcomings, and they will no doubt evaluate the book shrewdly. Vogt has made an interesting and fairly readable effort to scare people about some problems about which they ought to be scared.

It is regrettable that what might have been an extremely valuable book is so dangerously unreliable, since it is being widely distributed.

Free Speech and Its Relation to Self-Government

FREE SPEECH AND ITS RELATION TO SELF-GOVERNMENT. By Alexander Meiklejohn. Harper & Brothers, New York, N. Y., 1948. Cloth, 5 × 8 in., 107 pp., $2.

REVIEWED BY FRANK W. MILLER[2]

DR. MEIKLEJOHN refreshes our thinking in bringing to us concepts which we sorely need now. He is to be congratulated for directing us to the original text of the First Amendment to the Constitution and calling our attention to detours which may be disastrous.

Do we know what the First Amendment to the Constitution really means? Probably we, as engineers, say it doesn't matter, that it is the task of others. But, as engineers, taking a more active part in human relationships, we are obliged, by the nature of our desire to aid in such relationships, to become cognizant of the fine meanings of man's laws and their interpretations.

Engineers deal with the laws of nature and are not unfamiliar with laws as such, but man-made laws are subject to interpretations inconsistent with the original meanings. Correct interpretations are sometimes illusive unless studious thought is given to the law. We must examine decisions carefully to avoid being jolted from our mental equilibrium because some unforeseen danger presents itself. Dangers are not always clear to our concept when an alien field is invaded. In these cases we submit, sometimes too early, to the guidance of others. In this book engineers will be grateful to Dr. Meiklejohn for his reluctance to accept a dictum without freely discussing it, bringing to his aid in doing so the expert opinions of others.

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[2] Works Manager, Yarnall-Waring Company, Philadelphia, Pa. Mem. ASME.

Engineers should read "Free Speech and Its Relation to Self-Government" to help in preserving the true intent of our Constitution. Each person's thinking, when fully conditioned in democratic principles, assists in this endeavor because as a person thinks, so he does. We consciously or unconsciously influence our associates.

There are two kinds of civil liberties with which we are faced in evolving the phases of our daily lives. The author stresses the need for clarification of these in our thinking. This is essentially fundamental to intelligent performance of our lawful obligations as a self-governing society.

What is the principle of "clear and present danger?" How does this modify the First Amendment to the Constitution? Chief Justice Hughes is reported to have said when Governor of New York State, "We are under a constitution; but the Constitution is what the courts say it is." Is the First Amendment to the Constitution, as it is interpreted by the courts, compromised by this view as expressed by Governor Hughes when later, as Chief Justice, he interpreted our laws? Here are questions of fundamental importance to each citizen of the United States. They will be answered in one way or another, and our governing policies will be guided by these answers which consciously become woven into our national fabric.

To be happy under these decisions it is of vital importance that engineers become familiar with the present-day thinking and the way it affects their daily lives.

Engineers are taking a part and will take a more important part in our governing policies as they become qualified to enter into a more complete knowledge of our canons. Not only must engineers know fundamentals of engineering but they must also know the fundamentals of laws which are interpreted to govern society.

There is need for additional education so each one will be properly equipped mentally to evaluate the implications of "freedom of speech" which appear as lectures, magazine articles, books, etc. These may be subversive in nature, but, if we are well informed in the basic principles of a democracy, the decisions will be constructive and for the common good.

This book takes us back to fundamentals, to our inheritance of the hard-earned convictions of the early colonists, that we may keep them safe.

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Books Received in Library

ASM REVIEW OF METAL LITERATURE, Volume 4, 1947, edited by M. R. Hyslop. American Society for Metals, Cleveland, Ohio, 1948. Fabrikoid, 6 × $9^1/_4$ in., 720 pp. $15. This comprehensive survey of the metallurgical literature published during 1947 continues the useful series started in 1944. The brief abstracts indicate the scope and content. In addition to the main classified arrangement of the items, a detailed subject index and an author index are provided. The addresses of the journals and periodicals abstracted are given. Both American and foreign literature are covered in more than 8000 items included in the current volume.

ASTM STANDARDS ON COAL AND COKE, prepared by ASTM Committee D-5, American Society for Testing Materials, Philadelphia, Pa., September, 1948. Paper, 6 × 9 in., 156 pp., illus., diagrams, tables, $2. ($1.50 to ASTM members.) This publication brings together in convenient form the various ASTM methods of testing, definitions, and specifications for coal and coke, and the standard specifications for the classification of coal according to rank and grade. An appendix gives several proposed methods which the committee is studying.

ASTM STANDARDS ON PLASTICS, sponsored by ASTM Committee D-20 on Plastics, September, 1948, American Society for Testing Materials, Philadelphia, Pa. Paper, 6 × 9 in., 595 pp., illus., diagrams, charts, tables, $4.50. This useful compilation contains all of the 130 established and tentative specifications, methods of testing, and recommended practices for plastics issued by the American Society for Testing Materials. There are also five sets of definitions, a descriptive nomenclature of objects made from plastics, and a statement of the regulations governing the ASTM Committee on Plastics. The customary numerical list of the included standards is provided.

DESIGN OF WELDED STEEL STRUCTURES. By A. R. Moon. Second edition. Sir Isaac Pitman & Sons, Ltd., London, England, 1948. Cloth, $5^1/_2$ × $8^3/_4$ in., 134 pp., diagrams, tables, 18s. This textbook provides in concise form the necessary practical information which enables engineers and designers of constructional steelwork to make effective use of welding process. It covers the essentials of good design, metals suitable for welding, weld forms, and welding procedures. Typical joints and structural units are worked out and hints for avoiding distortion in the finished work are given.

DIESEL ENGINE CATALOG, vol. 13, 1948, edited by R. W. Wadman and others. Diesel Engines, Inc., New York, N. Y. Fabrikoid, $10^1/_2$ × $13^3/_4$ in., 454 pp., illus., diagrams, charts, tables, $10. The main part of this publication describes in detail the available industrial, marine, and railway Diesel engines, including new designs developed during the year preceding publication. The rest of the descriptive text is devoted to important Diesel accessories. A 150-page catalog with a classified buyers' guide is appended. The volume is copiously illustrated.

DIESEL ENGINE DESIGN. By H. F. P. Purday. Fifth edition. Constable & Company, Ltd., London, England, 1948. Cloth, $5^1/_2$ × $8^3/_4$ in., 545 pp., diagrams, charts, tables, 25s. The fifth edition of this text has been generally revised, parts rewritten, and many figures replaced with new illustrations typical of later practice. A new chapter has been added, which reviews the main problems of design and shows that the performance of a typical modern Diesel engine can be closely accounted for by known physical principles. The place of the Diesel engine with respect to other internal-combustion engines is also considered, with special reference to the recent development of the gas turbine.

ELASTICITY AND ANELASTICITY OF METALS. By C. Zener. University of Chicago Press, Chicago, Ill., 1948. Cloth, 6 × $9^1/_4$ in., 170 pp., illus., diagrams, charts, tables, $4. Of interest to physicists, metallurgists, and engineers, this book presents the science of the nonelastic behavior of metals at low stress levels. It considers the various types of anelasticity and develops their interrelations. A review is given of the various types of relaxations which have been found to give rise to anelasticity, and also of the dependence of the elastic properties of a metal upon its microstructure. Over 200 references are cited. The author points out the role which studies of this behavior will play in the future development of metallurgical science.

FUEL AND THE FUTURE. 3 volumes. Great Britain, Ministry of Fuel and Power. Published by His Majesty's Stationery Office, London, W.1, England, 1948. Paper, 6 × $9^1/_2$ in., diagrams, charts, tables, vol. 1, 370 pp., 6s; vol. 2, 374 pp., 6s; vol. 3, 211 pp., 3s, 6d. Vol. 1 of this report of an officially convened conference deals with the generation of steam, steam utilization, and heat for drying. Vol. 2 covers high-temperature processes, the carbonization and chemical industries, and several special industrial sessions. Vol. 3 presents modern heating in relation to the architect and fuel services in the home. Two simultaneous joint sessions on district heating and the sizing and grading of coal are also included.

Heat Pumps. By P. Sporn and others. 188 pp., 1947. John Wiley & Sons, N. Y., \$3.75. Thermodynamic principles, design, specification, and selection of equipment, maintenance, operating, and installation problems of heat pumps are considered; no attempt has been made to analyze the theory, performance, and design of heat-pump construction.

Injection Molding of Plastics. By I. Thomas. 534 pp., 1947. Reinhold Publishing Corp., New York, N. Y., \$10. The book is at once a simplified text for the layman, a handbook of technical data, and a complete survey of injection molding and the plastics industry.

Introduction to Applied Mathematics. By F. D. Murnaghan. John Wiley & Sons, Inc., New York, N. Y.; Chapman & Hall, London, England, 1948. Cloth, $5^3/_4 \times 9^1/_4$ in., 389 pp., diagrams, tables, \$5. Designed for graduate students and scientific workers with diversified interest, this book is a detailed and self-contained study of the mathematics used in modern physics and engineering. A methodical account is given of vector and matrix calculus, harmonic analysis, spherical harmonics, and Bessel functions. Also discussed are boundary value problems and integral equations, mechanical problems by means of the calculus and variations, and operational calculus.

Location of Economic Activity. By E. M. Hoover. McGraw-Hill Book Company, Inc., New York, N. Y.; Toronto, Canada; London, England, 1948. Cloth, $6 \times 9^1/_4$ in., 310 pp., diagrams, charts, maps, tables, \$3.75. This book presents an organized body of principles relating to the physical location of economic activities. It is primarily analytical rather than descriptive, devoting particular attention to problems of locational change and adjustment, and to objectives, methods, and implications of policies of public control. It develops ideas on the selection of locations for private and public facilities, land utilization, metropolitan and regional planning, and programs of industrial development and stabilization at local, state, regional, and national levels.

Machine Design. By P. H. Black. McGraw-Hill Book Company, Inc., New York, N. Y.; Toronto, Canada; and London, England, 1948. Cloth, $6 \times 9^1/_4$ in., 357 pp., illus., diagrams, charts, tables, \$4. Intended as a textbook for courses in general machine design, this volume also serves as a reference manual of established modern practice. Among the special features of the book are the following: surface finish, friction, and wear considerations; selection of vibration-absorbing units; allowable stress determinations; consideration of stress concentration in machine members, its applicability, seriousness, mitigation, determination, and design application. Fastenings and power-transmission units are also covered.

Mechanics. By J. P. Den Hartog. McGraw-Hill Book Company, Inc., New York, N. Y.; Toronto, Canada; London, England, 1948. Cloth, $6 \times 9^1/_4$ in., 462 pp., illus., diagrams, \$4.50. Covering the usual sophomore course in engineering mechanics, this text presents the subject in a clear and simple manner, with emphasis on the fundamentals of statics, kinematics, and dynamics. One of the outstanding features is the collection of 334 problems provided at the end of the book. Many other practical problems, with solutions in great detail, are treated as examples in the text.

Mechanics of Materials. By G. Murphy. Irwin-Farnham Publishing Co., Chicago, Ill., 1948. Cloth, $6 \times 9^1/_4$ in., 310 pp., illus., diagrams, charts, tables, \$4.50. To develop the student's understanding of the behavior under load of structural members and machine parts, this book emphasizes principles, considers standard procedures of analysis and provides indications that our knowledge of materials is constantly growing. The principles of statics, the characteristics of the geometry of the loaded member, and the effects of the properties of the material are stressed. Discussion of those topics which compose the first course in strength of materials is included.

Personnel Administration. By P. Pigors and C. A. Myers. McGraw-Hill Book Company, Inc., New York, N. Y.; and London, England, 1947. Cloth, $6 \times 9^1/_4$ in., 553 pp., diagrams, charts, tables, \$4.50. Emphasizing a new approach, this basic text stresses the philosophy of personnel administration rather than giving a detailed analysis of systems and procedures. Part 1 is divided into six sections: The nature of personnel administration; handling personnel problems; diagnosing organizational stability; building and maintaining work teams; wages and hours; and employee services and programs. Part 2 gives case material to illustrate the subject matter in the preceding sections. Most of the cases have been taken from unionized firms and therefore are representative of the industrial situation in America today. An extensive bibliography is included.

Pressure Vessels for Industry. By H. M. Spring, Jr. 259 pp. 1947. McGraw-Hill Book Co., N. Y. \$3.50. A practical guide to the design, construction, operation, selection, and maintenance of industrial pressure vessels.

Process Engineering. By W. H. Schutt. McGraw-Hill Book Company, Inc., New York, N. Y.; Toronto, Canada; London, England, 1948. Cloth, $6 \times 9^1/_4$ in., 309 pp., diagrams, charts, tables, \$4. Process engineering is considered as the phase of industrial engineering which determines the means, methods, and procedure of manufacturing an article economically. Detailed information is given on material selection, speed and feed formulas, the manual processes for all kinds of machining operations, estimating the size of blanks, and other items necessary for determining the direct-labor cost of an article to be manufactured. Specific cases of power-press work, machining, and assembling operations are carried through in detail to the final cost estimation.

Refractories for Furnaces, Kilns, Retorts, etc. By A. B. Searle. Second edition. Crosby Lockwood & Son, Ltd., London, S.W. 7, England, 1948. Cloth, $5 \times 7^1/_2$ in., 121 pp., illus., diagrams, charts, tables, 7s, 6d. Describing the characteristics of the chief raw and manufactured refractory materials, this small volume also considers the processes and materials employed in their production. Refractory hollow ware is discussed, and the last section deals with the selection of refractory materials. A short bibliography of books and publications is included.

Report of a Conference on Strength of Solids held at the H. H. Wills Physical Laboratory, University of Bristol, on July 7 to 9, 1947. Published by The Physical Society, London, S.W. 7, England, 1948. Paper, 7×10 in., 162 pp., illus., diagrams, charts, tables, 25s, plus 8d postage. The nineteen papers reprinted from the conference are divided as follows: nine on creep and plastic flow; six on grain boundaries and recrystallization; three on precipitation; and one on fracture, dealing with size effects in steels and other metals.

Rockets, Guns, and Targets. (Science in World War II, Office of Scientific Research and Development.) By J. E. Burchard, with a foreword by R. C. Tolman. Atlantic Monthly Press Book, Little, Brown and Company, Boston, Mass., 1948. Cloth, $5^1/_2 \times 8^3/_4$ in., 482 pp., charts, tables, \$6. This volume describes the work of three divisions of the National Defense Research Committee. Two were concerned with propulsion of missiles and the third with terminal ballistics. The development of solid-fuel recoilless weapons and related devices is presented as well as the work on the control of gun erosion, design and construction. The difficulties characteristic of wartime administration are described.

Sequential Analysis. By A. Wald. 212 pp., 1947. John Wiley & Sons, New York, N. Y., \$4. Gives a full discussion of the new statistical technique known as Sequential Probability Ratio Test; explains the fundamental theory, the applications, and potentialities of this method of analysis.

Society for Experimental Stress Analysis, Proceedings, volume 5, no. 2. Edited by C. Lipson and W. M. Murray, published and distributed by Addison-Wesley Press, Inc., Cambridge, Mass., 1948. Cloth, $8^1/_4 \times 11$ in., 153 pp., illus., diagrams, charts, tables, \$6. The sixteen papers presented in this volume cover various aspects of stress and strain analysis chiefly by strain-gage and photoelastic methods. Special topics dealt with are: a pendulum analyzer for mechanical transients; photogrid process for measuring strain in underwater explosions; the selection of allowable stresses for steel members; investigation of buckling shock mount.

Technical Writing. By K. Hendricks and L. A. Stoddart. Utah State Agricultural College, Logan, Utah, 1948. Cloth, $6 \times 9^1/_4$ in., 117 pp., diagrams, charts, maps, tables, \$1.50. This book is designed as a text for the student in technical writing and as a quick-reference manual for the experienced research worker. Every phase of research writing with the exception of sentence and paragraph construction is included. Emphasis is placed upon the gathering of material, the collecting of data and the handling of illustrations, footnotes, and cross references. Methods of exploring a field and recording the findings are considered.

Wear and Lubrication of Piston Rings and Cylinders. By Reemt Poppinga, translated from the German by E. Kurz, published by American Society of Lubrication Engineers, Chicago, Ill., originally published by the Verein deutscher Ingenieure, Berlin, Germany, 1942. Cloth, $5^1/_4 \times 8^1/_2$ in., 201 pp., illus., diagrams, charts, tables, \$3.50. Sponsored by the Institute for Motor Transport of the Technical University of Dresden and also by the Reich Ministry of Transport, this volume explains and investigates the wear of cylinders and piston rings. The influences of material structure, lubrication, and operating conditions are considered. The text and extensive bibliography presents a comprehensive picture of the state of research in this field up to the year 1940.

THE ENGINEERING PROFESSION

News and Notes

As Compiled and Edited by A. F. Bochenek

Engineers Joint Council

HOW well the Engineers Joint Council has fulfilled its function is evident in the increasing load of business coming before the Council. More and more when foreign scientific and engineering associations, visiting engineers, UNESCO, or the U. S. State Department, seek to call upon the profession, they do so through the facilities of the EJC. To cope more effectively with these expanding responsibilities on a world-wide front, the EJC recently streamlined its organizational structure by adopting a new constitution (story elsewhere on this page).

Since its creation in 1941 as the Joint Conference Committee of the Presidents and Secretaries of the Founder Societies, just 9 months after the collapse of the American Engineering Council deprived American engineers of a national spokesman, the EJC has been accepting responsibility and establishing its competence in dealing with broad professional problems. In spite of a limited budget, it has accomplished tasks which have enhanced the prestige of American engineers.

Conceived and sponsored as an interim body by the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Institute of Chemical Engineers, the EJC has come to represent an agency serving all American engineers.

When international congresses are planned, foreign scientific and engineering associations look to the EJC to accept responsibility for initiating American participation in these events. Engineers who visit the United States appreciate the practical aid in the form of itineraries and introductions which the EJC is able to provide.

EJC Disarmament Reports

At home among Federal authorities the EJC reports on the disarmament of Germany and Japan set a standard of disinterested public service and won respect for the engineering profession. As one result of the reports, the Department of State has turned to the EJC for aid on matters in which the engineering profession has competence. It is not uncommon for its representatives to appear at meetings of the Council.

When the EJC was selected to designate a representative on the U. S. National Commission for UNESCO (United Nations Educational, Scientific, and Cultural Organization), it gave recognition to the engineering profession as an entity not to be confused with learned bodies working in the pure and social sciences, and one which was entitled to its own representation.

The EJC has taken advantage of its opportunity to give voice to the American engineer in the councils of UNESCO. At Mexico City in September, 1947, R. M. Gates, past-president ASME, who attended the meeting as EJC representative, described the structure of American engineering to the world delegates, and told them of the willingness and ability of American engineers to contribute to the work of peace. Because of EJC, engineers were heard at the Pacific Regional Conference on UNESCO at San Francisco in May, 1948, and again at the UNESCO meeting held recently in Boston, Mass.

Interprofessional Contributions

There is ample evidence to suggest that the EJC has won recognition for engineers among sister professions. Recently, when the medical profession was confronted by medical problems in its research project for cancer control, the EJC was invited to appoint a committee of engineers to meet with the staff of the American Cancer Society and the National Research Council. The EJC Committee of Engineers Co-Operating in Medical Research has been meeting regularly with members of the medical profession and has already given substantial assistance.

Professional Unity

But aside from its international and interprofessional contributions, the EJC perhaps has served the engineers best by its work in the interest of professional unity. Handicapped by limited funds, the Council has been doing the necessary spade work upon which a unified enduring professional structure can eventually be built.

In its analysis of the various plans proposed, the Council has insisted on facts, and when these are not available, it organized to provide them. It has issued such reports as "The Engineering Profession in Transition,"[1] "Manual on Collective Bargaining for Professional Employees,"[2] and the first and second reports on "Employer Practice Regarding Engineering Graduates."[3]

Board Experience of Council

What success EJC has enjoyed in its work of promoting unity within the profession and recognition without, has been achieved primarily by the quality of its membership and its relationship to individual engineers. Composed of past-presidents, and the secretaries of ASCE, AIME, ASME, AIEE, and AIChE, the EJC brings to the council table men who by nature of their experience in engineering have an insight into the problems, aspirations, and prevailing opinions of their branches of the profession. While the secretaries contribute expert knowledge by virtue of their long association with administrative problems of professional organizations, the past-presidents, who during their terms in office, devoted much of their time to traveling and meeting with engineers in sections the country over, provide the Council with accurate knowledge of the nature and direction of thinking among engineers. This combination of experience and ability, coupled with devotion to the profession, has made for caution and mature judgment.

As the prestige of the EJC mounts, it is natural that engineers themselves should accord it greater recognition by working for a broader representation on the Council. The new constitution provides for such an expansion. Eventually, when American engineering societies agree upon some plan of unification the new over-all body will fall heir to a rich inheritance.

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[1] Digest published in September, 1947, issue of MECHANICAL ENGINEERING, pages 732–734.

[2] This 64-page booklet was described in the July, 1947, issue of MECHANICAL ENGINEERING, page 614.

[3] Preliminary report published in April, 1947, issue, pages 306–308, and supplementary report in January, 1948, issue, pages 13–16 of MECHANICAL ENGINEERING.

Engineers Joint Council Adopts New Constitution

THE Engineers Joint Council at its meeting on Nov. 22, 1948, replaced the old by-laws under which it has functioned since 1941 with a new constitution designed to expedite joint actions by its constituent societies and otherwise to improve service to the American engineering profession. A resolution emphasizing the EJC status as an interim body pending agreement by national engineering societies on an over-all body was also passed.

The new constitution restates the objectives of the EJC, modifies membership on the Council, provides for financial support by member societies, and establishes a workable quorum.

The constituent societies of the EJC are: The American Society of Civil Engineers; American Institute of Mining and Metallurgical Engineers; The American Society of Mechanical Engineers; American Institute of Electrical Engineers; and the American Institute of Chemical Engineers. Approved by all but one of the constituent societies, the new constitution became effective on Jan. 1, 1949. Minor amendments have already been agreed upon which will clear the way for final approval by all present member societies.

EJC Objectives

Objectives of the EJC as stated in the new constitution are: (1) To advance the general welfare of mankind through the available resources and creative ability of the engineering profession; (2) to promote co-operation among the various branches of the engineering profession; and (3) to develop sound public policies respecting national and international affairs wherein the engineering profession can be helpful through the services of the members of the engineering profession.

To achieve these objectives, the constitution states that the Council shall: (1) Act as an advisory and co-ordinating agency to seek and study matters of mutual interest to the constituent societies of Council and to recommend parallel action by them; (2) represent the constituent societies of the Council in instances in which constituent societies deem such joint representation to be desirable; and (3) administer on behalf of the engineering profession, those activities authorized by a majority of the constituent societies of the Council.

Membership

Under the old by-laws one of the major obstacles to EJC actions was the difficulty of getting a continuity of attendance of official members at meetings. Formerly each society was represented by its president, junior past-president, and secretary. Because of the heavy administrative loads carried by society presidents, and the incidence of illness among Council members, the Council often had difficulty in securing the viewpoint of all the participating bodies. To correct this situation the new constitution calls for each society to be represented by any two of its past-presidents and the secretary, and gives the active president an ex-officio status. It also provides that each member society "shall appoint an official alternate from the membership of its governing board, to act as a member of the Council with full privileges when any member of Council representing his constituent society is unavailable for the Council meetings; when not substituting for an unavailable member he shall have the privileges without vote and shall be expected to attend all meetings of the Council."

New Membership

Provision for enlarging the Council was written into Article II (3), which states that a "national engineering society may become a constituent society of the Council upon proof that the qualifications required of its members classify them as constituting a generally recognized branch or group of the engineering profession, and upon not less than a two-third affirmative vote of such constituent societies of the Council."

The constitution provides that cost of EJC activities is to be divided proportionately among the societies on basis of dues income from its members. Societies have the privilege of supporting specific activities proposed by the EJC and no society shall be required to participate in the cost of any EJC activities which it does not approve.

Great Britain, Canada, and United States Agree on Screw-Thread Unification

NEGOTIATIONS for unification of screw-thread standards by Great Britain, Canada, and the United States were successfully terminated with the formal signing of an agreement at the Bureau of Standards, Washington, D. C., Nov. 18, 1948.

According to the agreement, Great Britain gives up the Whitworth standard 55-degree thread form in use since 1845 and adopts the 60-degree Sellers screw-thread form developed in the United States in 1864. American representation at the unification conferences was organized by The American Society of Mechanical Engineers and the Society of Automotive Engineers under procedures of The American Standards Association. U. S. Government interests were represented by the Bureau of Standards. An account of the negotiations was published in the November, 1948, issue of MECHANICAL ENGINEERING, page 930.

Following the signing, Government officials of the three countries, and representatives of standards organizations and engineering societies hailed the agreement as one of vast significance to national defense and world trade.

William L. Batt, past-president and honorary member ASME, said that because of the agreement "democratic military forces may work most effectively together and industry be enabled to give the best satisfaction to its foreign customers. Mr. Batt as chairman of the Sponsors Council composed of four representatives each of The American Society of Mechanical Engineers, Society of Automotive Engineers and the American Standards Association, contributed much to the final success of the unification.

Screw-thread unification is but the first of several international standardization projects currently under discussion. At the ceremony, Sir Ewart Smith, chief engineer, Imperial Chemical Industries, London, announced that the British Ministry of Supply had approved use of third-angle drawing and drafting-room practice in some of their departments. Other unification discussions underway pertain to screw-thread nomenclature, cylindrical fits and tolerances, and types of gages and methods of gaging. These discussions when terminated are expected to provide a common language for the metal-working industries among the participating countries, which should

PACT SIGNING LINKS THREE NATIONS

[British, Canadian, and U. S. industry join in ceremony at National Bureau of Standards to sign international agreement standardizing screw threads. Climaxing 31 years of negotiation, historic agreement makes machine parts interchangeable for three nations. William L. Batt, past-president and Honorary Member ASME, president of SKF Industries, signs accord as (*left to right*) T. R. B. Sanders, British Minister of Supply; Dr. Edward U. Condon, U. S. Bureau of Standards Director; and Canada's Minister of Trade, Clarence V. Howe, look on.]

expedite production, decrease repair and maintenance costs, and thereby strike a blow against one of the most troublesome obstacles to the international exchange of tools, mechanical products, and engineering services.

Specific benefits expected from the screw-thread agreement, according to P. J. Des Jardins, chairman of one of the subcommittees of the ASME-SAE sponsored Sectional Committee on Standardization and Unification of Screw Threads (B1) are: (1) Expansion of world markets for American products; (2) reduction in cost for Canada and Great Britain in manufacturing for American consumers; (3) elimination of vast inventory requirements for multiple standard dies, gages, taps, and tools for screw, bolt, and nut production; (4) elimination of end-product duplicate inventories; (5) merging of inventories for domestic and foreign-market consumption; (6) lower costs for repair and maintenance for both household and business users of British, Canadian, and American mechanical goods; and (7) higher rates of production and longer production runs.

Over 40,000 Attend 1948 Power Show

THE Eighteenth National Exposition of Power and Mechanical Engineering at the Grand Central Palace, New York, N. Y., Nov. 29–Dec. 4, 1948 was attended by an exceptionally receptive audience of over 40,000. Nearly 400 exhibits crowded all the available space on four floors and the equipment displayed reflected the second great wave of improvements released since the end of World War II for the production, distribution, and application of power. The exposition was a success from every viewpoint and was largely attended by business executives, plant managers and superintendents, chief engineers, designers, research directors; civil, mechanical, electrical, mining and metallurgical engineers, and consulting engineers.

The exhibit of The American Society of Mechanical Engineers at Booth No. 80 located on the main floor of the Palace, attracted a large number of exposition visitors, many of whom came from other parts of this country and from foreign lands. The Society had on display a great number of its publications. The ASME Booth was comfortably furnished and as usual was a storehouse of information often vitally needed and readily furnished by competent attendants under the supervision of A. W. Schrage. The facilities of the booth were in constant demand during the week and it was the meeting place of members of the Society and of visitors seeking knowledge, information, and rest.

Exhibits, either actual size or miniature models, ranged from "packaged" steam generators up to apparatus of the largest sizes made for super power plants. Among the four hundred displays were heat and power-production systems and equipment, including steam boilers, stokers, turbines, engines, heat exchangers, etc.; automatic controlling devices; safety appliances; precision indicating and recording instruments; materals-handling equipment; metal and woodworking machinery, machine tools, and shop equipment; and new engineering materials including several new alloys.

The Power Shows always have been noteworthy for the presentation of elaborate displays in the way of models of plants and large equipment, and sectioned parts and working models, but this year's show excelled all previous efforts. Charles F. Roth was manager of the exposition and E. K. Stevens, associate manager.

EJC Labor Legislation Panel Reactivated

ANTICIPATING repeal or modification of the Taft-Hartley labor law which contains provisions for protecting engineers and other professional employees from coercion by labor unions, the Engineers Joint Council reactivated its 1947 Labor Legislation Panel to work toward retaining in any new legislation proper safeguards affecting professional employees.

During the 1947 Congressional hearings on the Taft-Hartley bill, the EJC Labor Legislation Panel was active in pressing for the right of engineers to decide for themselves whether they wanted to join a collective-bargaining unit.

As a result of EJC efforts, Congress recognized that professional employees had problems distinct from those of laborers and skilled workmen, and guaranteed to professional employees the right to organize their own bargaining units and to decide to refrain from or participate in bargaining units organized by established unions.

In reactivating the Panel, the EJC again invited the American Society for Engineering Education and the National Society of Professional Engineers to appoint representatives on the Panel. The Panel is under the chairmanship of E. L. Chandler, Mem. ASCE. William F. Ryan, Fellow ASME, assistant engineering manager, Stone and Webster Engineering Corporation, Boston, Mass., is the representative of The American Society of Mechanical Engineers.

PTC Committee No. 23 Holds First Meeting

THE Power Test Code Committee No. 23 of The American Society of Mechanical Engineers recently organized to revise the existing 1930 Test Code for Atmospheric Water-Cooling Equipment, held its first meeting at the Engineering Societies Building, New York, N. Y., Oct. 26, 1948. Among those present were representatives of cooling-tower manufacturers, petroleum refiners, utilities, universities, and consulting-engineering firms. In revising the existing code, the latest developments in theory, design, and practice in the field of atmospheric water-cooling equipment will be written into the new document.

Joseph Lichtenstein, Mem. ASME, Foster-Wheeler Corporation, New York, N. Y., as chairman of the Committee, presided and outlined the program for revision of the Code.

Conviction Made Under Ohio Engineers Registration Act

A CONTEMPT motion brought by the Ohio Society of Professional Engineers ended recently with a 10-day sentence and a $500 fine for contempt of court.

The defendent was found guilty of violating a court order, directing him not to represent himself as a professional engineer. The principal evidence against him was the listing for his company in the yellow pages of the Cleveland telephone directory.

The defence attorney said he considered the injunction beyond the scope of the law and believed that the defendent was in a category which was exempt from provisions of the engineers registration act. A test case is to be made.

According to the OSPE counsel, this was the first instance of defiance of a court order enforcing the registration act.

ASME BOOTH AT THE 1948 POWER SHOW

United Engineering Trustees Report for 1947–1948

Summary of Facts Concerning Finances, Building, Engineering Societies Library, and Engineering Foundation

THE Annual Report of the United Engineering Trustees, Inc., for 1947–1948 was issued on Oct. 28, 1948 by J. Schuyler Casey, president UET. Mr. Casey's[1] report in somewhat abridged form follows:

Forty-Fourth Year

At the time Andrew Carnegie gave money to erect a "union home" for the engineers, the several societies found it necessary to create a legal entity to perform for these several bodies such actions of joint interest which could not otherwise properly be conducted. Thus United Engineering Trustees, Inc., was created by the Founder Societies through an act of the New York State Legislature in 1904, with a membership equally distributed among the Founder Societies, appointed by them to represent and act for them in conducting any affairs of joint interest.

The immediate task was the titular ownership of Engineering Societies Building. The Founders' Agreement was signed by the proper officers of the Founder Societies as an irrevocable agreement to remain in, and to support their building. In 1913 a like agreement was signed by the officers of the Founder Societies for the establishment and perpetuation of Engineering Societies Library. The Board of Trustees of the Corporation and the Library Board alike being composed of members appointed by the Founder Societies, the societies were properly and authoritatively represented in the conduct of this Library, and the Board of Trustees was authorized by the Library Agreement, to apportion the expenses of operating Engineering Societies Library by assessment equally among the Founder Societies.

United Engineering Trustees, Inc., was likewise the logical custodian of Ambrose Swasey's and other gifts of money, the income from which was to conduct research in engineering and in scientific subjects; also of funds for the benefit of the Library.

The Corporation in turn received custody of other monies for joint interests of the Founder Societies, and was called upon to act as Treasurer for the Engineers' Council for Professional Development which is a Founder Society joint activity.

The charter of the Corporation empowers it to undertake work for the advancement of the engineering arts and sciences in all their branches; to maintain a free public engineering library; to own, use, maintain, occupy, and lease real estate, and requiring that the Founder Societies, together with such Associates as may be admitted, shall be assessed to pay expenses for maintenance and use.

Thus the Founder Societies created a structure to act for them, and in this creation, have an instrument capable of far greater use to them than is at present utilized. They have an instrument, not something apart, but a thing of their own creation and conduct, and their appointees as members of the Board of Trustees should be very close to the governing bodies of the Founder Societies, who can keep these Societies well-informed on the activities and problems of their joint interests.

Engineering Societies Building

The forty-one year old building has been kept in good condition, notwithstanding its age, but during the past year has required several major repairs. One of these, an extensive pointing job on the masonry especially of the upper floors—the three-top-floors addition completed in 1917 and apparently a war job with the mix showing signs of disintegration—was completed and approved by our consulting architects, who however, warned of the necessity of periodic inspections. This is a proper recommendation and will be followed up as a duty of our consulting architect. This includes basement leaks, which have been repaired.

Engineering Societies Building and land are carried on the books at $1,993,793.92. Against this is a Depreciation Fund of $664,258.53. The property remains exempt from taxation, but is carried on the City records to June, 1949, at $910,000, with the land at $410,000, which leaves the building value at $500,000.00.

Retirement Plan

After more than a decade of study of methods for pensioning older employees, a plan was put into effect at the beginning of the report year, with employee contribution—a plan almost identical with that successfully used for some years by the American Society of Civil Engineers, and by the American Institute of Electrical Engineers, with the principal difference in having the plan funds trusteed by a bank. The employees almost unanimously accepted the plan and became members. The plan is now before the Treasury Department for approval, as a safeguard against any future tax questions.

Financial Matters

During the year, a bequest was received from the estate of George Davis Barron, former Trustee and member of the Engineering Foundation Board. This generous bequest consisted of 4013 and a fraction shares of Cyprus Mines Stock. Owing to the remote location of this company, and the war shadows concentrating over the locale of the mining property, it was felt proper to liquidate this stock, for which we received $122,630.32 for the benefit of the Foundation principal.

Another very welcome gift was one from Bethlehem Steel Corporation to the John Fritz Medal Fund, $10,000. Until this gift, the Medal Fund had remained at only $3500 from the time of inception, 45 years ago. John Fritz Medal, generally recognized as the highest award in engineering, has been under the necessity over the years of obtaining financial assistance from the Founder Societies, and while the Medal Board had long been working on an increase in its Fund, this is the first definite assistance that has been given. John Fritz made great contributions to the early steel industry, and was associated with several of the earlier companies which later became part of Bethlehem. Their gift was in the form of a memorial to assure the perpetuation of the John Fritz Medal.

By-Laws

Changes to four By-Laws were made governing membership on the Library Board and aiming at simplification and greater efficiency in operating the Engineering Societies Library.

Detailed reports of the activities of these two departments of the corporation, the Engineering Societies Library and the Engineering Foundation, follow.

The Engineering Societies Library

IN his annual report to the Library Board, Ralph H. Phelps, director, Engineering Societies Library, New York, N. Y. stated:

The thirty-fifth library year, 1947–1948, has seen the initiation of a new bibliographic service, the simplification and improvement in techniques for handling several old services, consideration of co-operative action by New York libraries, and further study of the financial problems of the Library. No less important has been the continuation of good reference-book lending, photostat, search, and translation service, and the acquisition and cataloging of books and magazines.

This year there has been a continued general rise in costs. The cost of living, which perhaps is typical of rising costs generally, has risen 74 per cent since 1939—16 per cent in the last year. Library costs have risen more than library income but not as much as the cost of living. The net result of this is that the Library can purchase relatively fewer books and magazines, and the staff has relatively lower income.

By placing greater emphasis on paid services and by increasing the rates for services, the percentage of income from services has been doubled since 1939.

The deficit has been the chief concern to the UET, the Founder Societies, and the Library administration. Much study and planning during the last two years have been required by the financial difficulties of the Library. The "Committee on Library Objectives and Development" under the chairmanship of Prof. E. F. Church, Jr., presented an extensive report a year ago. This study, a "self-survey" of the ESL found the Library in need of space and materials, and in need of a larger staff to provide the service now demanded and to better that service. These deficiencies were primarily the result of insufficient funds. It recommended certain actions to correct these deficiencies. The report was later submitted to the UET.

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[1] Mr. Casey died Nov. 2, 1948.

A committee of the UET, under the chairmanship of K. W. Jappe, Mem. ASME, studied the report and on the basis of their report the action taken by the UET was: (1) To advise the Library Board that the Founder Societies could not raise their allotment at this time; (2) to direct the Library Board to institute a survey to reorient the ESL with other technological libraries in the country; and (3) to try to obtain support from industry.

The Library Study Committee, under the chairmanship of Ole Singstad, has formulated a plan for the survey, has considered various surveyors, and has a tentative agreement with one. The survey can be started and executed promptly when funds for it are available. Funds were made available by the Engineering Foundation at its meeting on Oct. 21, 1948.

Use of the Library

The use of the Library has leveled off this year after a spurt in the two preceding years that had raised Library use more than 20 per cent.

Coin holders mailed with books loaned to Founder Society members, new type call-cards for books, and added telephones in the reading room, are some of the changes which have improved service to members.

Miscellaneous Activities

Current magazines are continuously studied to determine their value, but, in addition, during the summer a full review was made of all magazines received. As a result, a few were dropped and some seventy will no longer be bound.

The staff of the H. E. Pinkerton Company makes considerable use of the Reading Room. As a result of discussions initiated by Mr. Pinkerton, an agreement has been reached whereby a contribution will be made to the Library based on the amount of use made of the Library's facilities by employees of the Pinkerton Company. The UET legal counsel has advised that the agreement should not affect the tax-exemption privileges now enjoyed, at least in part, because the ESL is a free public library. Two hundred dollars has been received for use of the Library facilities during the last three months. There is a possibility that the agreement can be made retroactive. If this is done, the Library will receive about $700 more for past use of facilities.

The amount of staff turnover has been less than any recent years. Staff efficiency is high and co-operation between departments and individuals is excellent.

Acquisitions, Cataloging, and Binding

Despite many gifts of books, maps, and searches, the Library still lacks many issues of valuable journals published in the last ten years and much time and effort are required to locate this material. Some of it is now available only in reduced photographic copy—four pages to one.

Over 13,000 catalog and index cards for the period January, 1942, to June, 1948, were microfilmed and the microfilm is now in the bank vault. In case of loss of the catalog, there would still be a record of the Library's holdings.

As in the past, the Library has received many valuable gifts of books and magazines. There were no outstanding gifts during the year, but some of the larger and more useful ones were those from the following: D. W. Barron, A. Eckwall, S. W. Farnsworth, M. Pirnie, B. W. Shaffer, and F. T. Sisco. Various technical societies, publishers, and other organizations have given generously of their own publications and other publications that have come to them.

The Library Board

The UET has changed the By-laws governing the Library Board, effective Oct. 21, 1948. The changes reduce the number on the Board from 22 to 12, and establish new standing committees on administration and budget. Hereafter, each Founder Society will have two representatives instead of four and the UET will have two representatives instead of one. There will be no members at large. The president of the UET and the director of the Library will be ex officio members of the Board.

The Engineering Foundation

IN their annual report to the United Engineering Trustees, Inc., A. B. Kinzel chairman, and Edwin H. Colpitts, director of The Engineering Foundation, stated:

The Engineering Foundation the research department of United Engineering Trustees, Inc., for the Founder Societies, was established in 1914 and completed its thirty-fourth fiscal year on Sept. 30, 1948. This has been officially known and referred to over the years as the Research Board, established by the munificent gifts of Ambrose Swasey and others for "the stimulation of research, and development work in the engineering profession." The income from these endowments was to "be available for such purposes."

As to utilization of income in the fiscal year, and of balance available from the previous years, grants were made for the year 1947–1948 in support of 18 projects. In addition to support and sponsorship of 16 research projects in various fields of engineering the Foundation continued to share in the support of the Engineers' Council for Professional Development, an organization which seeks the general advancement of the engineering profession.

As to the coming year, 1948–1949, grants are recommended for the continuation of 11 projects and for the support of two new projects.

The following projects are those in which the ASME is particularly interested:

Plastic Flow of Metals, Project 68

Chairman: A. Nadai, Research Laboratories, Westinghouse Electric Corporation, East Pittsburgh, Pa.

This project is divided into two specific projects, one at the Case Institute of Technology and one at the Massachusetts Institute of Technology, as follows: (1) Stress-Strain Relationships in Various Drawing Processes (C.I.T.); and (2) Rolling of Metals (M.I.T.).

As to project (1) George Sachs, who has been guiding the work at Case Institute of Technology, has resigned to accept a position in the East Indies but the Committee is now considering Prof. W. M. Baldwin as Professor Sachs's successor in this work. The immediate problem involves an experimental investigation of the flow of strip through circular tools. During the present year the efforts on this project have been directed in large measure toward the building of a small experimental rolling mill, which was, to a large extent, financed by the Institute and through gifts of materials supplied gratis by various industrial companies.

As to project (2) work during the year has continued actively at the Massachusetts Institute of Technology. A large part of the effort has been devoted to the development of experimental equipment and experimental methods. The first report for publication on the rolling-of-metals project, entitled "Contact Stresses in the Rolling of Metals—I," was prepared and presented before the Annual Conference of the ASME Applied Mechanics Division on June 19, 1948. This report will be published at a later date in the *Journal of Applied Mechanics.*

Properties of Gases and Gas Mixtures, Project 91

Chairman: ASME Research Committee on Properties of Gases and Gas Mixtures, J. A. Goff, University of Pennsylvania, Philadelphia, Pa.

As a result of preliminary studies and analyses of data collected from various sources it appears:

First: As disclosed by a survey covering industrial concerns active in the fields of power, refrigeration, chemical processing, and transportation, there is definite dissatisfaction with present knowledge regarding the thermodynamic properties of even the common gases such as oxygen, nitrogen, argon, hydrogen, helium, carbon monoxide, carbon dioxide, water vapor, etc. This survey also disclosed substantial interest in the thermodynamic properties of a large list of refrigerants, hydrocarbons, propellant gases, dissociation products, etc., which heretofore have not been subject to systematic investigation. Also, attention was called to the almost complete lack of reliable information regarding the thermodynamic properties of gas mixtures. Finally, this survey revealed the fact that a knowledge of the so-called nonthermodynamic properties, viscosity, thermal conductivity, diffusivity, emissivity, etc., is also urgently needed.

Second: As to facilities for work under way on gas-properties research, a survey shows there is considerable activity and a lively interest in gas-properties research in various laboratories, educational, industrial, and governmental.

The problem presented to the Committee seems to be to determine recommended priority and scope for research projects and, in some cases at least, to provide financial support for the carrying on of these projects, this general guidance being basic to a broad program of research covering a substantial term of years.

Applied Mechanics Reviews, Project 94
Chairman: Managing Committee, G. B. Pegram, Columbia University, New York 27, N. Y.

This project proposed the publication of a monthly digest magazine for applied mechanics to take the place of a similar German publication which had been abandoned because of the war. The U. S. Navy was interested in such a digest journal and promised certain financial support under contractoral terms.

After consideration by the interested divisions of the Society, the Managing Committee, consisting of G. B. Pegram, chairman, H. L. Dryden, and J. S. Thompson with the chairman of the Applied Mechanics Division and L. H. Donnell, editor, ex officiis, was organized to administer the contract and look after ASME interests. Also, an Advisory Board consisting of the various co-operating societies was organized to formulate policies. The co-operating societies are: American Society of Civil Engineers, American Institute of Physics, Institute of the Aeronautical Sciences, American Mathematical Society, Society for Experimental Stress Analysis, The Institution of Mechanical Engineers, and The Engineering Institute of Canada. In addition to the financial support of the Office of Naval Research, the Illinois Institute of Technology contributed office space and the Engineering Foundation a grant for the first year of operation.

An editorial office was set up at the Illinois Institute of Technology, Chicago, Ill., under the direction of L. H. Donnell, editor, and a subscription and production office at the Society Headquarters in New York, N. Y.

The first number of *Applied Mechanics Reviews*, vol. 1, no. 1, dated January, 1948, appeared early in February. Each issue contains approximately 200 reviews.

As of July 1, 1948, subscriptions totaled 2000 and it is expected that subscriptions will exceed 3000 as the journal becomes better known and the overseas market is further developed.

Meetings of Other Societies

January 10–14
Society of Automotive Engineers, Inc., annual meeting and engineering display, Hotel Book-Cadillac, Detroit, Mich.

January 19–22
American Society of Civil Engineers, annual meeting, Hotel Commodore, New York, N. Y.

January 23–27
American Society of Heating and Ventilating Engineers, 55th annual meeting, Stevens Hotel, Chicago, Ill.

January 31–February 4
American Institute of Electrical Engineers, winter general meeting, Pennsylvania Hotel, New York, N. Y.

February 14–16
American Management Association, personnel conference, Palmer House, Chicago, Ill.

February 17
National Industrial Conference Board, Inc., Hotel Waldorf-Astoria, New York, N. Y.

March 6–10
American Institute of Chemical Engineers, Los Angeles (regional) meeting, Los Angeles Biltmore Hotel, Los Angeles, Calif.

March 8–10
Society of Automotive Engineers, Inc., passenger car, body and production meeting, Hotel Book-Cadillac, Detroit, Mich.

(*For ASME Coming Meetings See page 106*)

RESA Is Organized

OPERATING under a constitution and by-laws that had been approved by the 49th annual convention of the Society of the Sigma Xi, which had closed a few minutes before, the first convention of RESA, the Scientific Research Society of America, was convened at the Hotel Cleveland, Cleveland, Ohio, on Saturday afternoon, Nov. 27, 1948, with George A. Stetson, editor ASME, chairman of the Board of Governors of RESA presiding.

By authority of a provision of the constitution, members and associate members of Sigma Xi present were enrolled as members of RESA and were given the lapel insigna of the new society. George A. Baitsell, executive secretary of Sigma Xi and treasurer of RESA, outlined the background of discussions and actions of the Executive Committee of Sigma Xi and the incorporators and officers of RESA in drafting the constitution and by-laws and incorporating and launching the society.

RESA an Outgrowth of Sigma Xi

RESA is a new scientific society organized by Sigma Xi and designed primarily to meet the needs of industry and research workers in industrial laboratories. It will be remembered that Sigma Xi is a scientific "honorary" society operating in the colleges and universities. Organized more than sixty years ago at Cornell, it spread throughout the universities of the nation as a society through which graduating and graduate students in science and engineering who showed promise in research could be recognized and encouraged by contacts with older men who had made their mark in these fields. As teachers and research workers moved from colleges where no Sigma Xi chapters had been installed to institutions where the society was a going and vigorous organization they became eligible for membership. And as members left the universities where they had been elected to membership and went to others where no chapter existed, they became leaders of local groups who petitioned the parent Society for the establishment of a chapter in that institution. Thus Sigma Xi has gradually grown in number of members and chapters until today it holds a position of great influence in almost every major university.

There existed, however, a blank spot in its organization which badly needed to be filled, that of the industrial research center which was not a part of a university and hence could not petition for a chapter. In these areas, which have grown tremendously, particularly in the last decade, there are hundreds of Sigma Xi members no longer affiliated with university chapters, and even more engineers and scientists who were graduated from institutions in which no Sigma Xi chapter had been installed at the time of their residence, and others whose scientific talents had not been demonstrated at the university or had flowered late in the industrial atmosphere. The parent society has grown continuously more conscious of this gap in its organization during the past few years and has been seeking a means by which it can be filled. Sigma Xi "clubs" were established in a few industrial laboratories as a stopgap means of meeting a growing need for an association of kindred spirits in science and engineering where the stimulus of intellectual contacts and of interchange of knowledge and friendship between men working in separate fields would be enjoyed. The formation of the Scientific Research Society of America, under the aegis of the Society of the Sigma Xi, is the result of the efforts of the parent society to extend its influence and benefits to scientists and engineers in the industrial field.

Officers and Board of Governors

By election by the incorporators of RESA as provided in the constitution the officers and members of the Board of Governors are as follows:

Chairman: George A. Stetson, editor ASME, New York, N. Y.; *Director:* Donald B. Prentice, former president, Rose Polytechnic Institute, New Haven, Conn.; *Treasurer:* George A. Baitsell, executive secretary, Sigma Xi, New Haven, Conn. *Board of Governors:* J. W. Barker, president, Research Corporation, New York, N. Y.; W. V. Houston, president, Rice Institute, Houston, Texas; M. C. W. Jones, Esso Research Laboratory, Elizabeth, N. J.; William Proctor, Bar Harbor, Me.; George A. Stetson; C. G. Suits, General Electric Company, Schenectady, N. Y.; C. A. Thomas, executive vice-president, Monsanto Chemical Company, St. Louis, Mo.; and E. R. Weidlein, director, Mellon Institute, Pittsburgh, Pa. Members of the Board ex officiis are Carl D. Anderson, president, George A. Baitsell, secretary, and George B. Pegram, treasurer, Sigma Xi.

Headquarters at New Haven

D. B. Prentice, director of RESA, told members in attendance at the convention that, through the kindness of Yale University, headquarters had been established at 54 Hill-house Ave., New Haven, Conn. This arrangement brings the offices of RESA in close contact (across the street) from the headquarters offices of Sigma Xi, whose executive secretary is treasurer of RESA, and will greatly facilitate administrative operations. Dr. Prentice also announced that a budget of expenditures amounting to $12,000 had been sanctioned by the incorporators and tentatively approved by the officers, subject to approval of the Board of Governors at its organization meeting.

Clubs and Branches

It was explained that RESA Clubs and Branches would be organized as soon as petitions could be acted on by the Board of Governors. A RESA Branch may be established "at any research institution, industrial, or other, in which active programs of scientific research are maintained and the publication of the results in standard journals is encouraged." A RESA Club may be organized "at any suitable place to engage in activities designed to further the object of this Society." A Branch may elect members and associate members of RESA, but a Club may not. Petitions for charters for Branches or Clubs must be signed by 12 members of Sigma Xi and sent to the Director at New Haven. Further details may be obtained by writing to the Director. A member or an associate member of Sigma Xi may be admitted to the corresponding grade in RESA upon registration. Enrollment may be made with a Branch or a Club or with the membership at large through the office of the Director, and upon payment of prescribed fees which are nominal.

It was announced that the first meeting of the Board of Governors would be convened as soon as possible and would meet as often as necessary to pass on petitions for charters for Branches and Clubs in anticipation of a national convention to be held, probably in New York, in December, 1949.

Conference on Materials Handling Planned at Purdue University

A materials-handling conference will be held at Purdue University, Lafayette, Ind., Feb. 21–22, 1948, under joint sponsorship of the Indiana Materials Handling Society and the Purdue University.

The program will be directed to that segment of management responsible for the formulation of policy in connection with this important function of production, and to those directly charged with the task of executing management's policies responsible for developing and operating materials-handling procedures.

Stating that basic problems are the same for small and large plants, the planning committee believes that representatives of a wide range of sizes of industries will be interested in hearing and discussing the advance information planned for presentation at this conference. Variation in solution of problems in small and large plants will be recognized.

The two-day program will be opened by a discussion of the topic, "Management Looks at Materials Handling," presenting a survey of the problem of materials handling from an over-all point of view. Two papers will follow: "The Production Problem of Materials Handling," by a production man; and "Accounting for Materials Handling Costs," by a cost accountant. Panel discussions will follow all speeches and papers presented at the conference. A special speaker and Purdue musical-organization entertainment will highlight the dinner meeting planned for the first day of the conference.

Engineering Index Volumes Wanted

COPIES of the bound volumes of Engineering Index from 1928 to date are needed by various libraries and organizations, both in this country and abroad. If you have volumes that you do not need, please get in touch with Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, New York.

Report of M.I.T. Conference on Mechanical Wear

A SPECIAL summer conference on mechanical wear was held at the Massachusetts Institute of Technology, Cambridge, Mass., on June 14–16, 1948, under the joint sponsorship of The American Society of Mechanical Engineers, the General Motors Corporation, and the Chrysler Corporation, together with M.I.T. The object of the conference was to take stock of the present knowledge and theories on this very important subject so that the most profitable directions of future research might be more clearly indicated. The absence of any general meeting on the subject in either the U. S. or Europe in recent years made this especially desirable.

Wear Experiences Discussed

The presented papers and accompanying discussion covered laboratory and service experience on wear in internal-combustion engines, steam turbines, brake materials, journal bearings, gears, electric brushes (in the absence of electric currents), surface plates, and cutting tools. In addition, results of laboratory tests on laboratory machines simulating some of these service operations and also on specially designed wear-test machines were reported. Specifically excluded from consideration at the conference were the subjects of cavitation erosion by liquids and the wear of current-carrying electric contacts.

Wear a Complex Phenomenon

It was the general concensus that the wear phenomenon is exceedingly complex and depends on numerous factors. The effect of some of these factors was discussed in considerable detail by one or more of the speakers. For instance, it was shown that a viscous lubricant could prevent metal-to-metal contact under high impact loading in the absence of any tangential sliding of the two surfaces. The difference between the hardness of a metal as measured by an indenter and the hardness that determines its friction and wear was analyzed. The lubricating properties of graphite were shown to be dependent on the presence of adsorbed oxygen and water-vapor films. In the absence of such films, as at high altitudes, carbon brushes wear severely. It was shown that certain types of oiliness additives would not react chemically with a freshly cut metal surface until after that surface had been exposed to air and moisture. The factors affecting the corrosive wear in automobile-engine piston rings were separated and the resulting wear rates measured. Data on the fatigue failure and the scoring or welding wear of gear teeth were reported. The electrical breakdown of the oil film in a journal bearing was shown to give some advance warning of incipient failure of the bearing.

The sixteen principal speakers included F. P. Bowden of Cambridge University, England, J. O. Almen of the General Motors Corporation, H. Blok of the Royal Dutch Shell, Delft, Holland, Prof. E. Buckingham of M.I.T., Paul S. Lane of the Muskegon Piston Ring Company, and N. L. Mochel of the Westinghouse Electric Corporation. In addition, there was much contributed discussion.

The complete proceedings of the conference will be published shortly by the American Society for Metals.

Oil-Engine Power Costs for 1947 Available

THE unprecedented demand for power throughout the United States is reflected in the 19th annual "Report on Oil-Engine Power Costs for 1947" recently published by the Oil and Gas Power Division of The American Society of Mechanical Engineers. Although nine fewer plants reported than in 1946 the net kilowatthour output represents an increase of approximately 15 per cent.

The 39-page report, which contains factual data only and makes no attempt at interpretation, gives information on performance and production costs of 117 oil-engine generating plants, containing 396 engines totaling 341,114 rated bhp. In the report, production cost is defined as consisting of the following items: fuel costs; lubrication cost; cost of attendance and superintendance; cost of supplies and miscellaneous; cost of engine and all other plant repairs.

The body of the report consists of three tables listing participating plants by descending order of size. Table I gives 26 items of information pertaining to production costs for 1947, such as type of plant, character of load, total net output kwhr, average cost of fuel and lubrication oil, and a breakdown of costs per net kwhr.

Table II tabulates comparative costs for each year from 1929 to 1947 where data is available. For example: Plant 164, which has reported production costs since 1930, shows that the average cost for fuel oil in cents per gallon has increased from 3.66 in 1930 to 7.19 in 1947, and the total production cost in mills per net kwhr from 6.07 to 12.93 during the same period.

Table III lists engine details and operating information needed to interpret production-cost data. In this table are reported such data as total gallons of new lubricating oil used, gallons of reclaimed used, lubricating-oil treatment, characteristics of fuel oil used, gross kwhr per gallon of fuel oil obtained, and others.

Also included in the report are three charts which plot lubricating fuel-oil economies against plant-running capacity factors in per cent.

The report was compiled by the subcommittee on Oil-Engine Power Costs of the ASME Oil and Gas Power Division under the chairmanship of H. C. Major, chairman, former commissioner of Public Utilities, Rockville Center, L. I., N. Y. Copies may be obtained from ASME Publication Sales, 29 West 39th St., New York 18, N. Y. Price per copy is $2.50 to nonmembers; $2 to members.

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WESTINGHOUSE Electric Corporation recently organized an Atomic Power Division which will concentrate solely on the harnessing of nuclear energy for the production of useful power. According to Gwilym A. Price, president, the new Division "will be available to undertake atomic energy projects for the U. S. Government as well as to carry on independent studies. It will conduct research, development, engineering, and any necessary associated construction." Charles H. Weaver, a former district industrial manager of the Corporation, will serve as manager.

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BCR Authorizes Half Million for Coal Research

TO create new markets and to hold and expand present markets, the board of directors of Bituminous Coal Research, Inc., Pittsburgh, Pa., the national research agency of the bituminous coal industry, authorized a research budget of more than half a million dollars for the second consecutive year.

This will finance the development of new equipment, methods for more efficient coal utilization, and fundamental research. The funds for BCR research are provided by 340 coal companies, railroads, and manufacturers.

The program outlined by BCR executives at the board's annual budget meeting in Pittsburgh, authorized the expenditure of $515,800 to continue the industry-sponsored general research program for 1949. This budget is exclusive of the programs being conducted by the BCR Mining Development and Locomotive Development committees. The authorized budget does not include substantial sums made available by cosponsors on certain projects of the general research program.

The work proposed for the coming year is for the most part a continuation of the 1948 program. Attention will be given to further development and commercial introduction of residential heating equipment, new methods of industrial coal utilization, and improved performance of steam locomotives. Several new projects will be undertaken in 1949, including work on cinder collectors for small plants and locomotive-fuel studies. BCR, in co-operation with Battelle Memorial Institute and others, will initiate a program on improved gas producers.

Support has been continued to BCR-sponsored fundamental research in coal gasification, combustion, and hydrogenation at the Coal Research Laboratory of Carnegie Institute of Technology and at the Massachusetts Institute of Technology, as well as studies of mine drainage at the U. S. Bureau of Mines and West Virginia University. BCR's support of co-operative house-planning research at the University of Illinois, a project leading to greater satisfaction from the use of coal by residential consumers, will be continued.

CANONS OF ETHICS FOR ENGINEERS

FOREWORD

Honesty, justice, and courtesy form a moral philosophy which, associated with mutual interest among men, constitute the foundation of ethics. The engineer should recognize such a standard, not in passive observance, but as a set of dynamic principles guiding his conduct and way of life. It is his duty to practice his profession according to these Canons of Ethics.

As the keystone of professional conduct is integrity, the engineer will discharge his duties with fidelity to the public, his employers, and clients, and with fairness and impartiality to all. It is his duty to interest himself in public welfare, and to be ready to apply his special knowledge for the benefit of mankind. He should uphold the honor and dignity of his profession and also avoid association with any enterprise of questionable character. In his dealings with fellow engineers he should be fair and tolerant.

PROFESSIONAL LIFE

Sec. 1. The engineer will co-operate in extending the effectiveness of the engineering profession by interchanging information and experience with other engineers and students and by contributing to the work of engineering societies, schools, and the scientific and engineering press.

Sec. 2. He will not advertise his work or merit in a self-laudatory manner, and he will avoid all conduct or practice likely to discredit or do injury to the dignity and honor of his profession.

RELATIONS WITH THE PUBLIC

Sec. 3. The engineer will endeavor to extend public knowledge of engineering, and will discourage the spreading of untrue, unfair, and exaggerated statements regarding engineering.

Sec. 4. He will have due regard for the safety of life and health of the public and employees who may be affected by the work for which he is responsible.

Sec. 5. He will express an opinion only when it is founded on adequate knowledge and honest conviction while he is serving as a witness before a court, commission, or other tribunal.

Sec. 6. He will not issue ex parte statements, criticisms, or arguments on matters connected with public policy which are inspired or paid for by private interests, unless he indicates on whose behalf he is making the statement.

Sec. 7. He will refrain from expressing publicly an opinion on an engineering subject unless he is informed as to the facts relating thereto.

RELATIONS WITH CLIENTS AND EMPLOYERS

Sec. 8. The engineer will act in professional matters for each client or employer as a faithful agent or trustee.

Sec. 9. He will act with fairness and justice between his client or employer and the contractor when dealing with contracts.

Sec. 10. He will make his status clear to his client or employer before undertaking an engagement if he may be called upon to decide on the use of inventions, apparatus, or any other thing in which he may have a financial interest.

Sec. 11. He will guard against conditions that are dangerous or threatening to life, limb, or property on work for which he is responsible, or if he is not responsible, will promptly call such conditions to the attention of those who are responsible.

Sec. 12. He will present clearly the consequences to be expected from deviations proposed if his engineering judgment is overruled by nontechnical authority in cases where he is responsible for the technical adequacy of engineering work.

Sec. 13. He will engage, or advise his client or employer to engage, and he will co-operate with, other experts and specialists whenever the client's or employer's interests are best served by such service.

Sec. 14. He will disclose no information concerning the business affairs or technical processes of clients or employers without their consent.

Sec. 15. He will not accept compensation, financial or otherwise, from more than one interested party for the same service, or for services pertaining to the same work, without the consent of all interested parties.

Sec. 16. He will not accept commissions or allowances, directly or indirectly, from contractors or other parties dealing with his client or employer in connection with work for which he is responsible.

Sec. 17. He will not be financially interested in the bids as or of a contractor on competitive work for which he is employed as an engineer unless he has the consent of his client or employer.

Sec. 18. He will promptly disclose to his client or employer any interest in a business which may compete with or affect the business of his client or employer. He will not allow an interest in any business to affect his decision regarding engineering work for which he is employed, or which he may be called upon to perform.

RELATIONS WITH ENGINEERS

Sec. 19. The engineer will endeavor to protect the engineering profession collectively and individually from misrepresentation and misunderstanding.

Sec. 20. He will take care that credit for engineering work is given to those to whom credit is properly due.

Sec. 21. He will uphold the principle of appropriate and adequate compensation for those engaged in engineering work, including those in subordinate capacities, as being in the public interest and maintaining the standards of the profession.

Sec. 22. He will endeavor to provide opportunity for the professional development and advancement of engineers in his employ.

Sec. 23. He will not directly or indirectly injure the professional reputation, prospects, or practice of another engineer. However, if he considers that an engineer is guilty of unethical, illegal, or unfair practice, he will present the information to the proper authority for action.

Sec. 24. He will exercise due restraint in criticizing another engineer's work in public, recognizing the fact that the engineering societies and the engineering press provide the proper forum for technical discussions and criticism.

Sec. 25. He will not try to supplant another engineer in a particular employment after becoming aware that definite steps have been taken toward the other's employment.

Sec. 26. He will not compete with another engineer on the basis of charges for work by underbidding, through reducing his normal fees after having been informed of the charges named by the other.

Sec. 27. He will not use the advantages of a salaried position to compete unfairly with another engineer.

Sec. 28. He will not become associated in responsibility for work with engineers who do not conform to ethical practices.

Prepared by Engineers Council for Professional Development
29 West 39th Street, New York 18, N. Y.

THIS $9^1/_2$ × 14-IN. PLACARD SUITABLE FOR FRAMING IS PUBLISHED BY THE ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

(The monogram and center heads are in red ink. Copies may be obtained from the ECPD, 29 West 39th Street, New York 18, N. Y., at 50 cents each; 35 cents each for 10 or more. These canons were incorporated in the ASME Constitution following favorable action by members on ballot of Aug. 19, 1948.)

Engineers and Contractors to Study Construction Costs

THE current high cost of construction will be one of the major targets of the new National Joint Co-Operative Committee recently established by the American Society of Civil Engineers and the Associated General Contractors of America.

The purpose of the Committee will be to recommend procedures in the public interest in fields where engineers and contractors have mutual interest. Included among the subjects to be studied by the committee are: Simplification of standard contract clauses for engineering construction; designs which can obtain maximum benefits from mechanized construction operations; clarification of bidding and awarding procedures; construction courses in engineering colleges; and attracting young engineers to the field of construction and design of public works.

Edmund A. Prentis, director, ASCE, will head the group of three members representing the American Society of Civil Engineers.

Survey to Improve Service Planned by ESL

A SURVEY of the Engineering Societies Library is being made to determine how it can better serve the engineering profession. Although the Engineering Societies Library currently serves 40,000 engineers annually, it is expected that the survey will show how the Library can be of greater value to the profession generally, and especially to the members of the four societies that founded and support the Library.

Thirty-five years ago the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, and the American Institute of Electrical Engineers joined their libraries to form the Engineering Societies Library which is administered as a department of the United Engineering Trustees, Inc. The survey is being financed by a grant from The Engineering Foundation and it is being made by Richardson King Wood. Members of the survey committee are: Ole Singstad, chairman, Frank T. Sisco, George Sutherland, James S. Thompson, Mem. ASME, Jerome K. Wilcox, Robert H. Barclay, and Ralph H. Phelps, director of the Library.

As a part of the program to increase the usefulness of the Engineering Societies Library, the United Engineering Trustees, Inc. has reduced the size of the Library Board from 22 to 12 so that it can act more quickly and easily.

The members of the Board for 1948–1949 are: James S. Thompson, chairman, Frank T. Sisco, vice-chairman, Harold M. Lewis, W. N. Carey, James Douglas, James L. Head, Theodore Baumeister, Mem. ASME, H. M. Turner, George Sutherland, K. W. Jappe, Mem. ASME, E. C. Meagher, and Ralph H. Phelps, secretary.

Education

THE NEED for closer teamwork between the colleges of engineering and industry was emphasized by Clement J. Freund, Mem. ASME, dean of the University of Detroit Engineering College, in an address before the Engineering College Administrative Council meeting at Washington, D. C., Nov. 7–8, 1948.

Dean Freund, who is also president of the American Society for Engineering Education, sponsors of the meeting, declared that "Engineering college enrollments have risen sharply from 9000 in 1926 to an anticipated 70,000 in 1950. The Manpower Committee of the Society believes that the engineering industries of the United States can absorb the sudden flood of veteran graduates during the next three years. However, in order to do so, certain additional outlets need development.

"Heretofore, engineering graduates and college placement officers have concentrated almost exclusively upon familiar positions in design, experiment and test, sales, research, and a few others. They have more or less neglected positions in plant engineering and maintenance, production and manufacturing, and the operation of plant facilities of whatever kind.

"Again, comparatively few small industries have engaged engineers heretofore. There are countless openings in thousands of small industries for practically an unlimited number of young engineers.

"However, in order to break open all these outlets, it will be necessary for the engineering faculties to establish much closer relations with the industries, and this applies particularly to the teaching members of the faculties rather than to the personnel officers."

S. P. TIMOSHENKO of Stanford University and Sir R. V. Southwell of the Imperial College of Science and Technology will be guest professors at a Symposium on Engineering Structures to be sponsored this summer by the University of Michigan, Ann Arbor, Mich.

CARL F. KAYAN, Mem. ASME, has been named head of the department of mechanical engineering at Columbia University's School of Engineering. He succeeds Prof. Theodore Baumeister, Mem. ASME, who resigned the post last July but continues as a member of the faculty.

SPECIAL laboratories for research in atomic energy will be a feature of new buildings to be built by the University of Notre Dame, South Bend, Ind., at a cost of $1,750,000, to house expanded facilities for a research program in nuclear physics, electronics, and radio-active substances.

THEODOR VON KÁRMÁN, director of the Guggenheim Aeronautics Laboratory at the California Institute of Technology, has been appointed an honorary professor of mechanical engineering at Columbia University, New York, N. Y. The distinction, rarely conferred by the University, is in recognition of his achievements in the field of aerodynamics.

Dr. von Kármán, who is chairman of the Scientific Advisory Board of the U. S. Air Force, was recently accorded two other honors. At the 1948 ASME Annual Dinner on Dec. 1, he was awarded the John Fritz Medal presented jointly by the Founder Societies. Two days later he received the Franklin Medal from The Franklin Institute, Philadelphia, Pa. A biographical sketch of Dr. von Kármán appears on page 82 of this issue.

People

TAYLOR LYMAN, member of the Advisory Board of the ASME Metals Engineering Handbook now in process of compilation, has been appointed associate editor of *Metal Progress* published by the American Society of Metals. He is well known for his editorship of the ASM "Metals Handbook."

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J. B. WOODWARD, JR., president, Newport News Shipbuilding and Drydock Company, Newport News, Va., was recently elected president of the Society of Naval Architects and Marine Engineers for a two-year period beginning Jan. 1, 1949.

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EDWIN O. GRIFFENHAGEN, senior partner, Griffenhagen and Associates, was elected president of the Association of Consulting Management Engineers, Inc., at the annual meeting of the association held at the University Club, New York, N. Y., Nov. 30, 1948.

* * *

LEWIS E. YOUNG of Pittsburgh, Pa., consulting mining engineer and formerly vice-president of the Pittsburgh Coal Company, was recently elected president for 1949, of the American Institute of Mining and Metallurgical Engineers.

SYDNEY F. DUNCAN, Mem. ASME, has been appointed head of the department of mechanical engineering, University of Southern California, Los Angeles, Calif. He succeeds Prof. Thomas T. Ayre, Mem. ASME, who is retiring after 20 years on the staff. Professor Duncan also directs activities of the Navy research project on jet propulsion being carried on at the University of California.

FORD L. WILKINSON, JR., Mem. ASME, dean of the U. S. Naval Postgraduate School, Annapolis, Md., has been appointed to the presidency of Rose Polytechnic Institute, Terre Haute, Ind. He succeeds Donald B. Prentice, Mem. ASME, who retired in July, 1948.

ALEXANDER G. CHRISTIE, past-president and Hon. Mem. ASME, was honored by colleagues and former students at a dinner held at the Johns Hopkins University, Baltimore, Md., Nov. 6, 1948. Dr. Christie, professor-emeritus of mechanical engineering, has completed 34 years on the staff of the University.

ASME NEWS

Members and Students Luncheon Addressed by President Bailey and President-Elect Todd

THE traditional ASME members and students luncheon, held in the grand ballroom of the Hotel Pennsylvania, Dec. 2, 1948, during the 1948 Annual Meeting, was attended by more than 600 young men and older engineers who not only enjoyed a good meal and honored recipients of ASME honors and awards, but spent a moment or two in mutual admiration.

The presiding officer was Paul B. Eaton, vice-president, ASME Region III, professor, department of mechanical engineering at Lafayette College, Easton, Pa. In his opening remarks, Professor Eaton commented on the lack of engineering statesmen, but said that there was one man who for the last year had made history in his career as an individual, an engineer, and a manager, and that he was truly an engineering statesman; whereupon Professor Eaton introduced President E. G. Bailey.

Old Guard Active

President Bailey, as toastmaster, then introduced one of the guests of honor, L. Austin Wright, General Secretary, Engineering Institute of Canada, Montreal, Que., Can. The President spoke of the Old Guard, through whose material assistance the luncheon for students each year is made possible. Mr. Bailey said that it was a good time to let the young men know what may happen to them after they have been members for 35 years. He said that of a committee of five of the Old Guard he had found not a single one without an engagement of some kind that prevented attendance at the luncheon, and that E. B. Ricketts, one of the five, broke an engagement to be present, which illustrated that retirement had been anything but retirement to these members of the Old Guard who were still so busy. The president then introduced Mr. Ricketts, who said that the Old Guard of the Society now numbers almost 1000, and indications are that this number will swell to 2000 before many years. These Old Guard members, he said, are members who have paid dues for 35 years, and who, due to the rules of the Society, no longer have that obligation. Many of these men felt that they wanted to continue financial support in the work of the Society so the Old Guard committee was formed to continue contributions and have been expending this monetary assistance in the interest of the student and junior members of the Society, for use in prizes and expenses of students who have won prizes. One of the present problems, he said, was not to raise money but to find out how they ought to spend it to best help the student and junior members to greater interest in the Society. He said that the chairman of the Old Guard, Charles G. Herbert, would be very glad to receive suggestions from the younger members as to what inducements should be offered, and that the committee would appreciate suggestions for bettering the work they are trying to do for the students and junior members.

Women Engineers Welcomed

President Bailey then spoke briefly. He said that he would like particularly to address the ladies present, and would like to encourage young women who wish to become engineers. He told of visiting a college recently and asking a young woman there what degree she was studying for. She replied "PhT." "But I never heard of that degree," said Mr. Bailey. "Oh that is 'Putting Husbands Through,'" remarked the young woman. Mr. Bailey spoke of the student luncheon as a real tradition, which no other Society he knew of has, and felt that it encourages youth and age to exchange ideas and hopes. He said that the education of the students when they leave school is only beginning and that the future education is in the engineer's hands—the kind of job, the kind of company, the individual company. Only the individual himself can receive and sift out all good and carry out his own initiative.

President Bailey then introduced President-Elect James M. Todd. Mr. Todd said that he sometimes asked himself if the students felt as he did—that he wondered if he would possibly live long enough to become a member of the Old Guard. The ASME, he said, was most anxious to develop its student relations and have a larger number of students, upon graduation, transfer to junior membership in the Society. Some of us, he remarked, were far from satisfied with the results because of out of 4000 student graduates each year approximately 50 per cent transfer to membership. It has been suggested that the difficulty is one of finances. But that cannot wholly be accepted as the reason, for the student graduating in June has until September to pay his dues of $10.

Other Professors Aid Their Young Men

Mr. Todd said that it had been his observation that young doctors and lawyers are accepted as in every way being qualified members of the profession following compliance with graduation and registration laws, and that their contacts professionally and socially with the older practitioners were much more close than those among engineers.

L. W. LEDGERWOOD, JR. (LEFT) WINNER OF THE POSTGRADUATE STUDENT AWARD, GREETING THOMAS L. DINSMORE, 1948 WINNER OF THE UNDERGRADUATE STUDENT AWARD AT THE MEMBERS AND STUDENTS LUNCHEON

Mr. Todd pointed out that the Society does not immediately accept an engineer as qualified in the same degree, but elects him a junior or other grade of member according to his years of experience.

"We have always made it a point to have young engineers fully understand that although registered, they are still juniors," he said. "Perhaps there may be some way of changing this by having their membership in technical societies be as professional engineers in a given branch, with some other term for the engineer of long experience. We must emphasize the importance of our young engineers for they are what helped build America and the American way of life, and there is a great load of hard work ahead for them," Mr. Todd declared.

Awards

Professor Eaton then introduced the winner of the undergraduate student award, Leroy William Ledgerwood, Jr., whose prize-winning paper was entitled "Hired Technicians or Professional Engineers."

Thomas L. Dinsmore received the postgraduate student award for his paper "An Experimental Investigation of the Stresses in Eyebars."

The Charles T. Main award was presented to Earle Duane Stewart for his paper "The Relation of Invention to Engineering."

The program concluded with a brief exposition by Walter G. Vincenti of his paper "Categories of Research in Dynamics" for which he received the Pi Tau Sigma Medal award for outstanding achievement in mechanical engineering.

For biographical sketches of award winners, see pages 82–85 of this issue.

300 Attend Eleventh National Fuels Conference

Ralph A. Sherman Receives 1948 Percy Nicholls Award

MORE than 250 mining and mechanical engineers working in the solid-fuels industry attended the Eleventh National Fuels Conference held at the Greenbrier Hotel, White Sulphur Springs, W. Va., Nov. 3-4, 1948, to discuss such subjects as the national coal reserves, progress of the synthetic-liquid-fuels program, status of mechanical mining in Europe, evaluation of domestic stoker coals, and others.

The conference was sponsored jointly by the Coal Division of the American Institute of Mining and Metallurgical Engineers and the Fuels Division of The American Society of Mechanical Engineers with the co-operation of the AIME Central Appalachian Section.

In addition to three technical sessions at which seven papers were presented, the program included a luncheon, a banquet, and a social program for the wives of delegates.

The lush atmosphere of the resort hotel at which the conference was held provided an ideal background for the fellowship and cheer characteristic of an engineering meeting.

1948 Percy Nicholls Award

A feature of the banquet was the presentation of the Percy Nicholls Award to Ralph A. Sherman, Mem. AIME and ASME. Mr. Sherman, who is director at large of the ASME, and assistant director, Battelle Memorial Institute, Columbus, Ohio, received the award for scientific achievement in the field of solid fuels. E. G. Bailey, retiring president ASME, presented the main address. Speaking on the subject "Engineers' Opportunity in the Field of Fuels," Mr. Bailey pointed out that there was need for researchers in the basic field of coal utilization and that it was regrettable that the more glamorous fields of electronics and atomic energy attracted many men away from this important field.

ASME Calendar

of Coming Events

April 25-29, 1949
ASME Oil and Gas Power Division Conference, Hotel Sherman, Chicago, Ill.

May 2-4, 1949
ASME Spring Meeting, New London, Conn.
(*Final date for submitting papers—Jan. 1, 1949*)

June 27-30, 1949
ASME Semi-Annual Meeting, San Francisco, Calif.
(*Final date for submitting papers—Feb. 1, 1949*)

Sept. 28-30, 1949
ASME Fall Meeting, Erie, Pa.
(*Final date for submitting papers—May 1, 1949*)

Nov. 27-Dec. 2, 1949
ASME Annual Meeting, New York, N. Y.
(*Final date for submitting papers—Aug. 1, 1949*)

(*For Meetings of other Societies see page 101*)

As luncheon speaker, G. R. Spindler, Mem. AIME, Joy Manufacturing Company, Brussels, Belgium, discussed mechanical mining in Europe. Of particular interest from a mechanical viewpoint were the coal-cutting machines which were being used to cut and load coal in a continuous operation. Some of his slides showed pictures of miners' houses and surface coal-mine buildings which were impressive brick structures and illustrated why such large capital outlays were required to begin mining operations in Europe.

New Estimate of U. S. Reserves

Paul Averitt, Mem. AIME, U. S. Geological Survey, Washington, D. C., told the conference that a new and detailed estimate of U. S. coal reserves was under way which would take ten years to complete.

"The coal fields of the United States are large in all dimensions," Mr. Averitt said. "They cover roughly 350,000 square miles, or approximately one ninth of the total area of the United States. The coal-bearing rocks commonly are several thousand feet thick, and, as in West Virginia, contain as many as 117 named and correlated coal beds. An estimate of the coal reserves in this great volume of rock is an expensive and time-consuming job."

Currently used figures on U. S. coal reserves were last revised in 1928, and only minor changes have been made since, Mr. Averitt pointed out. Though substantial revision of these figures was deemed necessary, lack of funds in the years following precluded the work, he said. However, much new data were amassed, particularly on the Montana coal fields, and therefore a re-appraisal of reserves in that state began the national program of the Geological Survey. This is now nearing completion.

Field work is in progress or reports are in preparation at present on 13 detailed mapping projects, including the Pennsylvania anthracite field, and fields in Maryland, Kentucky, North Carolina, Alabama, Montana, Wyoming, four fields in Colorado, and in New Mexico and Washington.

Detailed field mapping includes information on areas of outcrop of coal beds, their range in thickness, nature of roof rock, amount of overburden, that is, the thickness of rock overlying the coal, correlation of the beds, stratigraphy and structure of the coal-bearing rocks, and the preparation of coal-reserve figures based on these data, Mr. Averitt declared.

Synthetic Liquid-Fuel Program

A program for the production of one million barrels daily of synthetic oils from coal was outlined by J. D. Doherty, Mem. AIME, assistant chief of the Office of Synthetic Liquid Fuels, Bureau of Mines. Describing work in research and development already under way by the Bureau and others in the production of synthetic liquid fuels, Mr. Doherty called for prompt erection of at least some commercial plants because "synthetic liquid fuels are not going to do us very much good in an emergency if we have to start from scratch."

Based on estimates of the Bureau of Mines, the program calls for a total investment of 8.7 billion dollars, including plants, mines, and product pipe lines.

The million barrels per day of oil from coal would consist of the following products: liquefied propane and butane, 86,000 barrels; high-grade motor gasoline, 648,000 barrels; Diesel and furnace oil 266,000 barrels. Heavy fuel oil, which could be obtained more cheaply from shale, was not included. Aviation fuel requirements "which would skyrocket in the event of a national emergency," could readily be produced by coal hydrogenation, one of the two principal processes employed, the speaker said. The production cost per gallon of total products would be 12.4 cents, or 12.6 cents, depending on the process used.

About half of the production would be from coal east of the Mississippi River and half from coal and lignite west of the Mississippi. The requirement would be 575,000 tons per calendar day. This would amount to 210 million tons per year, a 34 per cent increase over 1947 production. Of this consumption, 213,000 tons per day would be bituminous coal from the East; 362,000 tons would be coal and lignite mined in the West.

The Bureau of Mines has under way research and development work in both the principal processes. Extensive work is being carried on by most of the leading oil companies and other industrial firms, particularly on the gas synthesis process, Mr. Doherty said.

Co-Operative Research

On Thursday morning Elmer R. Kaiser, Mem. ASME, presented a paper on organizing and financing co-operative research which stimulated much comment. H. N. Eavenson, in commenting on the paper, pointed out several fields which he thought needed research attention. Among these were coal-mine haulage and prevention of gob fires. Research "must justify itself in cold hard cash," said J. B. Morrow, and that although co-operative research is needed, money was going to be harder to get. Another point of view was expressed by Pres. E. G. Bailey, who thought that organized research held back the individual inventor. A good researcher, he said, should not stay within the narrow limits of his own field but should go out and observe what is going on in other fields.

Speaker at the luncheon, Carl E. Miller, Mem. ASME, technical adviser, Battelle Memorial Institute, Columbus, Ohio, recently returned from Europe where he had been working for the Europeon Recovery Program, told of utilization of fuels in England and on the continent.

Notice of Importance to All ASME Members

Nominations Open for 1950 Officers

THE 1949 National Nominating Committee of the Society is now requesting proposals for candidates for the offices to be filled during 1949, which are as follows:

President	To serve 1 year
Vice-President	To serve 2 years Region I
Vice-President	To serve 2 years Region III
Vice-President	To serve 2 years Region V
Vice-President	To serve 2 years Region VII
Directors at Large (2)	To serve 4 years

Early Action Necessary

Proposals for the Society's membership will be welcomed by the Committee, and those who intend to submit them are urged to act promptly. Candidates' names and records should be submitted on the official proposal form which may be obtained from the Secretary or any member of the Nominating Committee as listed below. Completed forms should be sent to the Committee through the Secretary, H. R. Kessler, Republic Flow Meters Company, 420 Lexington Avenue, New York 17, N. Y., not later than April 1, 1949.

Before submitting the name of a candidate, his consent to serve should be obtained by the proposer. The proposer, not the candidate, should fill out the form. Members are reminded that, in accordance with the Society's Constitution, candidates for the office of President, Vice-President, and Director at Large shall be of the Grade of Fellow or Member of the Society.

Members wishing orally to support the candidacy of a proposed nominee will be given an opportunity to do so at the Committee's open hearings at the Semi-Annual Meeting in San Francisco, Calif.

You and Democracy

THE search for good men to lead the Society is the privilege and responsibility of every member. The search must begin at the grass roots, in the byways of our industrial centers, in all the Regions and Sections, where engineering administrators and leaders are demonstrating their ability.

In a democratic organization each man must accept responsibility. You, as a member of the ASME, have the responsibility to nominate for national office the members in your industry or community whose leadership can benefit the ASME.

Unless you act, the democratic process cannot function. The ASME Nominating Committee does not initiate nominations. It is your service agency whose sole function is the selection from the leaders you name, the most able of the able, a slate of officers, which you as a member can approve or reject by national ballot.

The time to act is now. The Nominating Committee is accepting nominations for 1950. Write to the secretary for a nomination form. Write to the member on the Nominating Committee from your Region. Share with the nation the superb leadership developed in your Region.

1949 National Nominating Committee

Region I. T. A. Fearnside, Stone & Webster Engrg. Co., 49 Federal St., Boston 7, Mass.; E. W. Harrington, 1st Alt., Manufacturers Mutual Fire Insurance Co., 1550 Turks Head Building, Providence, R. I.; R. G. Chapman, 2nd Alt., University of Vermont, Burlington, Vt.; and L. A. Lachman, 3rd Alt., Farrel-Birmingham Co., Inc., Water St., Stonington, Conn.

Region II: H. C. R. Carlson, 209 Clinton Ave., Brooklyn 5, N. Y. H. R. Kessler, Secretary, Republic Flow Meters Co., 420 Lexington Ave., New York, N. Y.; and V. W. Smith, 2nd Alt., Lummus Co., 420 Lexington Ave., New York, N. Y.

Region III: P. C. Osterman, American Gas Furnace Co., Elizabeth, N. J.; Henry H. Snelling, 1st Alt., Snelling and Hendricks, 900 F St., N.W., Washington 4, D. C.; and William G. McLean, 2nd Alt., Department of Mechanics, Lafayette College, Easton, Pa.

Region IV: S. B. Earle, School of Engineering, Clemson College, Clemson, S. C.; Claude L. Huey, 1st Alt., Babcock and Wilcox Co., 1604 Candler Building, Atlanta, Ga.; and Louis G. Haller, 2nd Alt., Tennessee Eastman Corp., Kingsport, Tenn.

Region V: Tomlinson Fort, Central Station Department, Westinghouse Electric Corp., East Pittsburgh, Pa.; J. W. Brennan, 1st Alt., American Blower Corp., 8111 Tireman Ave., Detroit 32, Mich.; and F. F. Borries, 2nd Alt., 5685 Belmont Ave., Cincinnati 24, Ohio.

Region VI: Wm. H. Oldacre, chairman, D. A. Stuart Oil Co., 2727 South Troy St., Chicago 23, Ill.; G. R. McNeile, 1st Alt., 806 East Miner St., South Bend 17, Ind.; and H. L. Heywood, 2nd Alt., Kearney and Trecker Corp., 6784 West National Ave., West Allis, Wis.

Region VII: Bertram G. Dick, Department of Interior, Bonneville Power Admin., 827 N.E. Oregon St., Portland, Ore.; Fairman B. Lee, 1st Alt., Lee and Freeman, Inc., 1550 1st Ave. South, Seattle 4, Wash.; and Herbert I. Chatterton, 2nd Alt., Everett Pacific Shipbuilding and Drydock Co., Everett, Wash.

Region VIII: A. A. Woodward, Public Service Co. of Colo., 900—15 St., Denver 2, Colo.; Henry B. Atherton, 1st Alt., Kansas City Power and Light Co., 1330 Baltimore Ave., Kansas City 1, Mo.; and Venton L. Doughtie, 2nd Alt., University of Texas, University Station, Austin 12, Tex.

ASME Woman's Auxiliary Celebrates 25th Anniversary at 1948 Annual Meeting

Mrs. R. B. Purdy Elected 1949 President

AT THE ASME 1948 Annual Meeting, the Woman's Auxiliary of The American Society of Mechanical Engineers celebrated its 25th anniversary with sight-seeing tours and social events attended by 377 members and guests. In charge of the program were Mrs. C. H. Young, honorary chairman; Mrs. H. R. Kessler, general chairman; and Mrs. J. H. Hochuli, vice-chairman of the Metropolitan Section.

Monday, Nov. 29, was devoted to greeting and registering guests from out of town and local communities under the able direction of Mrs. F. M. Farmer.

The main event of the day was the annual tea dance held in the Georgian Room of the Hotel Pennsylvania. The chairmen for the occasion were Mrs. F. M. Farmer, Mrs. Chas. Gladden, and Mrs. T. A. Burdick, with the assistance of Mrs. Crosby Field and her "AsK me Girls." Honored guests, Mrs. E. G. Bailey and Mrs. James Todd as well as Mrs. Earl B. Smith and Mrs. H. R. Kessler, poured.

The music was provided by Eddie Worth and his orchestra. It was difficult to resist the attractively decorated table set with dainty sandwiches and pastries. A large group enjoyed this pleasant social gathering.

Sight-Seeing Tours Popular

Tuesday morning, Nov. 30, a bus trip to La Guardia Airport was conducted by Mrs. Norman Dahl and Mrs. C. J. Sibler. The afternoon was devoted to a sight-seeing trip of Manhattan by bus. Chairmen were Mrs. Wm. I. Iliff and Mrs. G. Harman. Both bus trips terminated at the Engineering Woman's Club at 2 Fifth Ave. where a tea was held under the chairmanship of Mrs. Crosby Field. A capacity attendance enjoyed a piano recital by Prof. Roy E. White.

Wednesday, Dec. 1, Mrs. Earl B. Smith, national president of the Woman's Auxiliary, presided at the annual business meeting. Mrs. Harold Erb, chairman of the Student Loan Fund, reported over $9700. Mrs. W. E. Karg reported over $700 in the Calvin W. Rice Memorial Scholarship Fund.

1949 Officers

After the section reports, the national officers for the ensuing year were announced as follows: President, Mrs. R. B. Purdy; 1st vice-president, Mrs. F. W. Miller; 2nd vice-president, Mrs. J. P. Harbeson, Jr.; 3rd vice-president, Mrs. C. M. Hickox; 4th vice-president, Mrs. A. B. Openshaw; 5th vice-president, Mrs. R. R. Robertson; recording secretary, Mrs. A. M. Feldman; corresponding secretary, Mrs. J. M. Labberton; treasurer, Mrs. C. H. Young; and assistant treasurer, Mrs. C. Gladden.

The meeting was addressed by the President, E. G. Bailey, and also by the sponsor, Past-President Eugene O'Brien.

The annual luncheon was one of the outstanding events of the week with a record attendance of 154. Luncheon was served at the Hotel New Yorker, and seated on the dais were the chairman, Mrs. H. R. Kessler and the honored guests of the Auxiliary, Mrs. E. G. Bailey, Mrs. James Todd, Mrs. Earl B. Smith, national president, and Mrs. C. H. Young, Mrs. R. B. Purdy, Mrs. W. E. Karg, and our student, Arne Norman of Norway.

The chairmen of the luncheon were Mrs. George Nigh and Mrs. Harold Erb, who arranged a very interesting program consisting of a fur-fashion show and lecture by Paul Herrmann and Gladys Wilson. A fur scarf, donated by Mr. Herrmann, was won as a door prize by a lucky lady from Louisiana. The models were selected from our members and were Mrs. C. Kayan, Mrs. W. W. Clinedinst, Mrs. C. Jobst, Mrs. E. Oberg, Mrs. J. Rennie, Mrs. V. Kropf, and Miss C. Schuerer.

Arne Norman, Calvin W. Rice student, was introduced by Mrs. W. E. Karg. He gave an interesting address and expressed his thanks to the Auxiliary through whose efforts he is attending an American university.

The evening was devoted to the Annual Dinner and Honors Night where the usual festivities prevailed.

Thursday, Dec. 2, the Committee secured tickets for various radio-participation shows and also arranged for a guided radio and television show. An unusual luncheon was held at the Stockholm Restaurant where Swedish smorgasbord was served. The chairman of the day, Mrs. E. A. Lundstrom, introduced the honored guest speaker, Consul Gunnar Dryselius of the Royal Consulate of Sweden. In harmony with the occasion a technicolor movie "Vikings," a Scandinavian travel picture, was shown by courtesy of the American Airlines. This concluded the planned program and was enjoyed by all.

Reported by MRS. H. R. KESSLER.

Research and Development Reserve Officer Groups Being Organized by Army

THE Department of the Army has established a program of particular interest to mechanical engineers and other scientists who hold reserve commissions in the Army, and who are professionally engaged in teaching or research and development.

The objectives of the program are to: (1) Maintain the useful affiliation of mechanical engineers and other scientists with the organized Reserve Corps; (2) provide peacetime reserve assignments for these officers, enabling optimum utilization of their education, experience, and skills; (3) furnish mobilization assignments which will fully utilize their talents; and (4) adequately prepare these officers for mobilization.

The technical services of the Department of the Army submit to these Research and Development Reserve Groups research problems and projects which pose an intellectual challenge to members of the group. Thus the program provides members of each group a type of training which is in keeping with their scientific and technical interests and competence, rather than a traditional kind of training session in which scientists have little or no interest.

18 Groups Now Active

The program is now being implemented only in those areas where there is a definite local interest. To date, eighteen Research and Development Reserve groups have been organized. Twelve additional groups are in process of organization. Others are in the initial stages of formation. Several of these groups have been formed in communities in which large universities, industrial research laboratories, or private research foundations are located. Typical localities are Chicago, Ill.; Wilmington, Del.; Newark, N. J.; Houston, Texas; Washington, D. C.; Manhattan and Lawrence, Kan.; and Detroit, Mich.

Provision is made to submit research projects of interest to all categories of scientists—chemists, physicists, engineers, geologists, geographers, psychologists, mathematicians, and all of the biological scientists.

Twenty or More in Groups

Reserve officers who are currently engaged in civilian research, college or university teaching, or industrial research or development, or who in the past have had specific research experience are eligible to make application for assignment to an Organized Reserve Research and Development Group. A group may be organized in any locality where there are 20 or more qualified officer scientists who desire to participate in the program.

A subgroup may be organized with ten qualified members.

Outline of Program Available

The program is under the general direction of the Research and Development Group, Logistics Division, General Staff, United States Army. The entire program is outlined in Department of the Army Circular Number 127, dated May 5, 1948.

Inquiry about organization of an Organized Reserve Research and Development Group or about assignment to a group already organized should be made of the Unit Instructor, ORC, or of the Senior Army Instructor, ORC, in the locality in which the officer resides. In localities in which a group has already been organized, the commanding officer of the group will consider applications for assignment of additional officers.

ASME Junior Forum

Compiled and Edited by a Committee of Junior Members, B. H. Edelstein, Chairman

Society Officers Sit in With Junior Committee at 1948 Annual Meeting

The meeting of the National Junior Committee held at the Hotel Pennsylvania, New York, N. Y., Dec. 2, was attended by 20 juniors from 5 Regions and came near to making a clean sweep of the top-level officers at the 1948 ASME Annual Meeting. The presence of President E. G. Bailey, President-Elect James M. Todd, Past-President Eugene W. O'Brien, and Vice-Presidents Paul B. Eaton and A. R. Mumford gave ample evidence, if evidence was still needed, of the importance which ASME leadership places on junior-member activities. Also present were C. E. Davies, secretary ASME, C. J. Freund, dean, college of engineering, University of Detroit, Detroit, Mich., and George Thom, adviser to the National Junior Committee.

The meeting was the thirteenth since the Junior Committee was created in 1946 to study ASME services to junior members and to suggest how these could be improved. It was purposely delayed until the Annual Meeting so that juniors from other regions could sit in with the committee and give it the benefit of their comments and suggestions.

Donald E. Jahncke, chairman of the Junior Committee since its inception, opened the meeting by cordially welcoming officers and others who were giving up other important meetings to be present among the junior members. He then proceeded to direct discussion to three important matters: the formation of Junior Groups, improvements to the "Junior Forum," and the policy on junior advisers on national Society committees.

Following the reading of the minutes of the last meeting, Mr. O'Brien suggested that all minutes of the committee be sent to Society officers to keep them informed of what juniors were trying to do.

Junior Groups

Mr. Jahncke reviewed the aims and accomplishments of his committee, and asked for frank discussion from the floor. The first point taken up was the matter of Junior Groups. He said that when the committee first began its work he had been of the opinion that the formation of Junior Groups in sections where membership was in excess of 200 would give juniors the best opportunity for participating in ASME activities. Because of the concern expressed in some quarters, however, that Junior Groups tended to divide the membership into two age groups and to keep younger men from participating in regular section activity, thereby depriving them of association with older members, he no longer held that opinion.

C. J. Brous, Jun. ASME, of Jeannette, Pa., was quick to support the Junior Group idea. On the basis of the committee's pamphlet, "It's Up to You," Mr. Brous told how junior engineers in his company, the Elliott Company, organized a junior group not yet affiliated with the ASME, which has been eminently successful in organizing a program which has won the support of young engineers. He attributed the success to the thirst of young engineers for basic information about their profession, which was usually too elemental to appeal as subject matter from regular section meetings. Junior engineers are eager to learn, he said. They want to hear speakers who will discuss theory, basic processes, and fundamental economics in a manner that smacks of the classroom rather than those who tailor their remarks to hold the interest of older engineers. Only by planning their own meetings can juniors secure such speakers. Citing from his own experience, he told how junior-member attendance at regular meetings of his Section had been built up once junior members developed the habit of taking advantage of junior meetings.

Other juniors from smaller sections felt with Mr. Jahncke that if the Junior Group idea was pursued too far junior members would lose contact with older members, a consideration of equal importance to the young engineer as the acquisition of information. After the discussion had explored digressive avenues, Dean Freund, who had listened intently to both points of view, clarified the issue by saying that after all young engineers had two objectives: (1) They wanted programs tailored to their needs; and (2) they wanted to associate with older engineers. There seemed no reason, he thought, why juniors could not organize junior groups to achieve one objective and at the same time participate in section activities which would bring them in contact with established members of the profession.

Before the subject was dropped, Mr. O'Brien suggested that juniors could play a spotlight on their activities by planning a dramatic session at the next Annual Meeting. He had in mind a meeting sponsored solely by junior members. Such a meeting, to which students and junior-award winners would be invited, could follow the regular Members and Students Luncheon.

"Junior Forum"

C. H. Carman, vice-chairman of the National Junior Committee, reviewed the development of the Junior Forum and asked whether the Forum was being read. He told how the editorial committee was striving to obtain contributions from other regions to make the page reflect the interest of junior members other than those of the Metropolitan Section. He wanted frank discussion and suggestions for improvement.

In the discussion that followed it was evident that the Forum lacked something. Mr. Brous asked for articles more pertinent to the interests of juniors. Mr. Thom, who said

JUNIOR MEMBERS MET WITH THE NATIONAL JUNIOR COMMITTEE TO HEAR A REPORT OF ITS 1948 ACTIVITIES

(Seated at the head of the table, *left to right:* D. E. Jahncke, chairman; C. H. Carman, Jr., vice-chairman; J. B. Burkhardt; and Robert Nelsen.)

he had given some thought to the content of the Forum, read the following list of topics on which juniors could contribute articles to the Forum: (1) What my company is doing to "integrate" young engineers; (2) what are the junior activities in my section; (3) why I like my job; (4) define some problem and tell how you would go about solving it; (5) describe the function of some division of the Society; (6) describe an engineering personality you know well; (7) what are your hobbies; and (8) review some book of interest to engineers.

The list of article ideas made an impression on members present. It was suggested that many opinions had been expressed which in themselves would make interesting reading; therefore should be reduced to writing and submitted for consideration of the Editorial Committee.

Junior Advisers

J. B. Burkhardt, Jun. ASME, from the Chicago Section, who had made a study of Society committee structure to determine which of the committees could use the services of a junior adviser, reported that in his opinion juniors could serve on the following additional committees: Admission, Membership Development, Membership Review, Engineers Registration, and Education Committees.

It was also suggested that all junior advisers be made members of the National Junior Committee which could serve as the clearinghouse of junior thinking. Another idea considered was that the Old Guard might wish to pay part of the traveling expenses of junior advisers if they become convinced that experience as junior advisers truly benefits young men serving in such capacity.

Boston Junior Members Sponsor Section Meeting

EARLY last fall the Program Committee of the Boston Section appointed a Junior Program Committee to sponsor a meeting of their own planning. The Committee approached its task with the idea that a fairly complete schedule of technical meetings had been planned by the senior committee, and that some sort of a social get-acquainted meeting was needed. To accomplish this it seemed advisable to have the program consist of several different parts no one of which would last long enough to become boresome, but in their entirety would provide an evening full of entertainment, and an ample chance to make new acquaintances.

The resulting program began with an inexpensive buffet supper served by a caterer. Next followed one of the better safety movies of the year, "The Miracle of Paradise Valley," produced by Sinclair Oil and borrowed from the files of The New England Power Service Company, Boston, Mass. Then came the quiz program which was preceded by everyone singing the following jingle to the tune of "Twinkle, Twinkle, Little Star."

Asme, Asme, sends a greeting
To all the members at this meeting.
Come next month, the following too,
At every meeting we'd like to see you.

Asme, Asme, hits the spot.
Twelve full issues, that's a lot.
Applied Mechanics Journal too,
That should be enough for you

Asme, Asme, counts a lot.
Asme, Asme, helps you out.
Ten bucks is a lot to pay,
But every day it really makes hay.

Asme, Asme, has a wonderful gang.
Find your pal and let movies go hang.
They're all good fellows and underpaid too,
So greet the fellow that sits next to you.[1]

Quiz Program a Hit

William T. Alexander, dean, college of engineering, Northeastern University, Boston, Mass., consented to be the quiz master and presided very successfully by virtue of his natural wittiness and originality. The questions for the most part were chosen by lot. A number was drawn from a small goldfish bowl which corresponded to a number printed on the back of someone's name tag. If he answered the question incorrectly, he was given a small prize, and another number was drawn. This was repeated until the correct answer was obtained, at which time the prize was presented for answering that question correctly. There were ten questions, some technical, and some about ASME. Door prizes were also presented.

Col. Frank M. Gunby, vice-president, ASME Region I, was the main speaker. His topic was "Development of the Young Engineer." Col. Gunby began with pertinent observations from his own life. He has had a lot of fun, and said that life could be very interesting and enjoyable if one would make it so. He quoted from the Declaration of Independence, ". . . . that among these are Life, Liberty, and the pursuit of Happiness." Col. Gunby put the accent on "pursuit." One way to do this was to have a hobby. He had used the National Guard.

The One-Part Man

To be an engineer one must be human, the first requirement of all men. Other things that were common to all engineering problems were the dollar and the day. He quoted an old friend who said that if an ideal man was made up of five parts, and you wanted men with just one of those parts, you could get them by the bushel. If a man having two of the parts were required it would be very difficult. A man of three of the parts might be obtained if there were a partnership available. As far as a man of four parts was concerned, one might wonder if that man would have anything to do with him. A man of five parts was unobtainable. It was unwise to specialize so far as to be just a one-part man.

Colonel Gunby learned a lot about advice a long time ago when he worked for two brothers. One gave out much unsolicited advice of little value. The other gave advice only when asked. The three answers that Colonel Gunby received were, qualify oneself to take responsibility, learn to draw because drawing is about one half of the engineer's vocabulary, and learn to help the other fellow.

Experience gives meaning to the facts one knows, he said. It took experience in order to design something that was practical. A carpenter was once asked if he could construct a building from the engineer's calculations. The carpenter replied that he did not even know that engineers made them. He was used to working from drawings. Try to learn the meaning of details. That was one way of acquiring valuable experience, Colonel Gunby stated.

We all make mistakes, but the engineer miscalculates most in computing estimates and costs. One reason was the low factor of safety allowed. For steel, 4.0 was used. Financially, however, even a factor of 1.10 would get one into trouble. An estimating value often neglected was a factor of habit. Colonel Gunby then brought to mind a local incident that happened last spring. An inbound locomotive jumped the tracks and removed about a dozen columns that supported portions of Boston's Back Bay Station. But the structure did not collapse. It stood there as it always had. The only engineering explanation was that it had been there so long that it remained in position out of force of habit.

Another piece of advice received by Colonel Gunby in his younger days was, "Young man, learn to know people." The ASME was a good place to do it.

ASME Opportunities

Colonel Gunby then proceeded to give a brief outline of theadministrational organization of the ASME, describing the human and technical aspects. He exhibited a 50-page booklet which contains the names of section, professional division, and student branches, and other committee officers. There was here plenty to interest all, and if one could not find anything of interest, he was pretty hard to please.

The engineer must be ethical. An ASME Code of Ethics was originated back about 1917. At present a Canon of Ethics has been adopted by the joint engineering societies. It all sums up to the result: Be a gentleman.

Some ask, "What do I get out of ASME?" One gets out of it all that he puts into it plus compound interest. If one has put in nothing, one receives nothing. It is generally accepted that to do nothing, get nothing; do a lot, get a lot. Everything cannot be done at once, nor can all the results be seen at once. Remember, it takes time. Some men have had many jobs, as many as fifty, others very few. Both types have been happy and successful. It's up to you.

Reported by JOHN G. WILSON.[2]

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[1] Composed by Robert B. Green, Assistant in Mechanical Engineering, Massachusetts Institute of Technology, Boston, Mass.

[2] Assistant Engineer, New England Power Service Company, Boston, Mass. Jun. ASME.

Book Review

Technique for Leadership

THE TECHNIQUE OF BUILDING PERSONAL LEADERSHIP. By Donald A. Laird. McGraw-Hill Book Co., Inc., New York, N. Y., 1944. Cloth, $5^{1}/_{2} \times 8$ in., 32 illus., 239 pp., $2.75

REVIEWED BY DONALD E. JAHNCKE[1]

MOST people want better jobs. They want to be bosses. Yet one of every organization's greatest difficulties is to find people who can be leaders. Corporations are ever on the search for people who can lead, and many go to considerable expense to develop leadership in promising employees.

Through a series of very interesting anecdotes Dr. Laird points out that ***your*** ability to lead people can be developed. This development can be centered around some very definite rules, but over and above the rules the spirit and will to accomplish is more important. A mechanical logical leadership is not as effective as one with personality. You must put your heart into it.

Dr. Laird names nine general qualities required in a personality for leadership. These qualities are listed below.

Personal Magnetism

To illustrate what he means by personal magnetism and how it can be acquired, Dr. Laird tells a number of stories about individuals like Fiorello LaGuardia, Theodore Roosevelt, Charles M. Schwab, Thomas Lipton, Benjamin Franklin, and Lloyd George. Though in different fields, all of these people had magnetic personalities, a large part of which was developed in later life.

For personal magnetism that wins people Dr. Laird advises that you: (1) Be active; (2) be cheerful; (3) be exciting; (4) be brisk; (5) be direct; and (6) be fearless.

Poise

Can you take a reprimand without blowing up? Can you take a turn down without being visibly discouraged? Can you laugh with the others when the joke is on you? Can you keep your spirits up when things go wrong? Can you speak in public without being noticeably ill at ease? Can you keep cool in emergencies?

The natural leader answers all of these with a confident, "yes." It is poise that makes one master of such situations. The natural leader often is a person who has deliberately acquired this poise.

For poise to make you master of situations Dr. Laird advises you to: (1) Think about the other person; (2) touch a talisman; (3) think twice before talking; (4) take slow deep breaths; and (5) talk your troubles over.

Self-Confidence

C. Bedell Monro, president of Pennsylvania Central Airlines, had the initiative and vision to give up a college job and it's relative security, to pioneer in aviation. His first airplane burned before he had a customer. Far from discouraged, he got some 200 people enthusiastic about backing a new airline, based on a short haul rather than the transcontinental principle, and at the age of 26 organized his present firm. By selecting key men who can assume responsibility and who have the guts to use their judgment, he has built up one of our dominant airlines.

For self-confidence to control others, Dr. Laird recommends that you: (1) Put long trousers on childhood memories; (2) secretly belittle others; (3) put your best foot forward; and (4) put money in the bank regularly.

Optimism

The cheerful spirits of a young stableboy caught the attention of Andrew Carnegie. "Why don't you come to work with me?" Carnegie asked him. "You're the kind of fellow I need in my business." And so Charlie Schwab was launched on his fabulous career in steel. His good-spirited optimism got him the job and made him one of the master businessmen of his time. It enabled him to sell the elder J. P. Morgan the idea of combining small steel companies to form a giant. Older men had been unable to sell this idea to the financier, but smiling, optimistic Charlie Schwab did it.

Being optimistic is one of the essential ingredients that you must have to weather out the inevitable hurricanes of business life. To have optimism that gets enthusiasm you should: (1) Act optimistically; (2) smile, actually laugh; and (3) like people, even pessimists.

Tactfulness

Want to cut your own throat? If you do, just forget how to be tactful.

There was Lloyd. He had had to fight for everything in life and after he got through college and into a promising factory job he kept right on fighting instead of using tact. He mastered his job quickly, was given more responsibility, and felt he was due for a raise. One day the boss called him to the office and Lloyd felt in his bones it was about the raise. It was, in a way.

The boss told him he was doing a good job in every respect but one. He left too many ruffled feelings in his wake. He would get a raise, the boss said, when he found out how to work tactfully with people.

"The biggest raise we can ever give you," the boss said, "is four rules to follow in your relations with others, whether in the shop, home, or on the street. Follow these four rules and you will always leave people thinking better of themselves, and that is tact."

Here are the four positive rules that helped Lloyd and have helped many others: (1) Treat everyone as if he were your superior; (2) consider the opinions, customs, whims, and prejudices of others; (3) use constructive "smile words" and phrases; (4) swap envy for friendliness.

Progressiveness

Some 300,000 businesses are discontinued each year. Why? Is it unfair competition, lack of opportunity, or dishonesty?

Most of these small businessmen, manufacturers, storekeepers, have to go out of business because they are set in their ways. The official records report it as "poor management," which is a tactful way of saying that most of them were in ruts and would not change their business methods to meet the changed conditions. And conditions are ever changing—new machinery, new methods, new materials, new laws, new competitors, new employees, and new customers. Change is inevitable.

To keep progressive for leading others you should: (1) Mingle with others—attend ASME meetings; (2) keep your feelings insensitive; (3) be tolerant of others' opinions, (4) look ahead—think ahead; and (5) use effort to keep ahead of the times.

The successful executive looks two ways—to the past to study experience—to the future to apply it.

Initiative

There is no shortage of opportunities. Rather, there is a shortage of people who are wide awake enough to jump into the opportunities. There are opportunities on every hand—literally millions of things that need to be done, waiting for leaders to start them.

Harvey was an Ohio farm boy who did not think in terms of self-alibis. His initiative was not in a wheelchair. When he had saved a thousand dollars as a buggy salesman he located a partner who had half that much and together they started a rubber factory in Chicago. They planned to make rubber tires for buggies but competitors kept them from using the necessary patented machine.

Harvey's life savings were at stake. They had not made a single tire. Did he think of all the reasons why he should give up and return to selling buggies? Not Harvey S. Firestone. He got a mechanic and together they experimented. By using his initiative he found a better and cheaper way to make the tires without using the patented machine. He became independent of the patented monopoly because he thought positively.

For initiative to get things going you should: (1) Be dissatisfied; (2) change your wishbone for a backbone; (3) be positive; (4) take on more work; and (5) wean yourself.

"Stick-to-Itiveness"

Dr. Laird tells this story on himself. For many years he has kept a magic rule on his desk. It has literally been worth more than its weight in gold. When he has an impulse to quit the rule keeps him at work. When he becomes discouraged it whispers encouragement. When he stops too long to watch the river the rule calls him back.

It all started because a Maryland friend of his was bitten by the bug of the Colorado gold rush. This friend hurried out to Colorado and discovered a very rich vein of ore. He soon learned that hand methods would not be adequate to take full advantage of the deposits and pursuaded his friends back in Maryland to invest money for gold-mining equipment. Shortly after the equipment was installed the ore vein ran out and the friend, becoming discouraged, sold the equipment to a secondhand dealer.

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[1] Director of Manufacturing Budget Control, Lincoln-Mercury Division, Ford Motor Company, Detroit, Mich. Jun. ASME.

Another person took this equipment and by digging just three feet further found another rich vein.

The original owner was made bankrupt by the mine but it also made him rich by the lesson it taught "to stick to it," not to quit at the first discouragement. Those three feet that he neglected to dig in Colorado haunted him. Back east he became a salesman. Those three vital feet made him a star salesman. When he was given "no" as an answer he would come back to the prospect later and dig another foot, then another, and usually made a sale.

To remind him of this story Dr. Laird bought a three-foot folding rule back in 1920. He claims that it has done magic for him ever since.

When you feel like quitting, let a three-foot rule give you a rap on the knuckles and knuckle down to finish the job. Leadership is obtained only by sustained action.

To develop a stick-to-itiveness which will get things done you should: (1) Sink your ships; (2) change your grip; (3) say "no" to yourself; (4) use obstacles for stepping stones; and (5) pretend it's easy.

Power Over Time

In addition to all of the above characteristics you must also learn to organize your time constructively. Not only should you make thoroughly effective use of your time during the working day but you should take advantage of your free time to expand your knowledge and ability to get along with people. By using just one hour per day for activities of this sort you can gain the equivalent of one and one-half extra months in a year!

Time can be regarded as the space in a bucket. Your "obligated" segments of time, working, sleeping, and eating, can be regarded as large pieces of gravel. In between these large pieces can be fitted many small stones—your "free" time. These are the one-hour and two-hour periods we ordinarily neglect. The remaining voids in the bucket can be filled with grains of sand. These grains represent the ten and fifteen-minute segments of our life which most of us completely waste. Is your bucket full?

Letters

Why Have a Junior Group?

To the Editor:

THE ASME has a high percentage of juniors in its membership, and it might be of interest to these men all over the country to know what the Junior Group of the Metropolitan Section is doing this year.

You may ask, "Why a Junior Group?" It is necessary because, first, it is a good place to formulate ideas and to bring up the problems of juniors. Second, it can and should stimulate junior activity, by and for juniors. And third, it should be a sounding board for the views and interests of juniors. However, in order to be successful, it is necessary that juniors take an active part in the operation of the Group, and later, in the Society itself.

In line with policy, the Junior Group has on its program for this year a meeting dealing with the economic problems of the junior engineer, and a social evening. It is also sponsoring a competition for the best junior paper in the Metropolitan Section. There will be a $25 cash prize for this paper. Also, the group is offering a $10 credit toward the first year's junior membership in addition to the usual prize offered by the Metropolitan Section for the best student paper presented at the Region II Student Conference. There are also the usual committees hard at work trying to increase active participation, to get more publicity, and on various other problems. One of these is the starting of a social fund so that juniors may enjoy more social meetings in addition to the technical ones.

The Junior Group serves as a connecting link between the juniors and seniors and enables juniors to participate in the affairs of the Society. It is in a sense a steppingstone or springboard for later work in the Society itself. It gives juniors a chance to work with men of their own age, and men who have the same problems, hopes, and desires. It is basically a group of juniors who are interested in the affairs of juniors in the Metropolitan Section. However, the old adage, "We only get out of it what we put into it," still holds true.

ROBERT G. BIEDERMANN.[1]

Award Offered for Best Letter

THE South Texas Section places service to junior members among its first problems of the season since more than half of the membership is composed of juniors. To stimulate interest among these young engineers, the College Station Group of the Section has announced an award of transportation and dinner to some Houston meeting to the junior who submits the best letter on "How the South Texas Section Can Serve Its Junior Members More Effectively."

Actions of 1949 ASME Council

MEMBERS of the Council of The American Society of Mechanical Engineers serving during the administrative year 1948–1949 held their first meeting at the Hotel Pennsylvania at 8:30 p.m. on Monday, Nov. 29, 1948, following a dinner for Council Members and Council Members Elect. The meeting was preceded by the closing session of the 1948 Council whose activities during the opening days of the 1948 ASME Annual Meeting are reported on pages 51–58 of this issue.

E. G. Bailey, president, presided and introduced the new and re-elected members of the Council: Director at large, Ralph A. Sherman, vice-presidents, A. R. Mumford (II), Arthur Roberts, Jr. (IV), Forrest Nagler (VI), and Carl J. Eckhardt (VIII); and the President for 1949, James M. Todd. He then presented the gavel to Mr. Todd who called to order the first meeting of the 1949 Council.

Certificates were presented to the following retiring members of the Council: Vice-presidents Linn Helander, Thomas S. McEwan, and Edward E. Williams; and directors at large Wilber A. Carter and Lewis F. Moody.

Past-president E. W. O'Brien, at the request of Mr. Todd, presented to E. G. Bailey the special emblem for retiring presidents, and the Council, on motion, extended to Mr. Bailey "its grateful thanks and deep appreciation for his fine contribution to the Society during his administration."

Appointments

Appointment was voted of C. E. Davies as secretary, K. W. Jappe as treasurer, and J. L. Kopf as assistant treasurer of the Society for the year ending with the 1949 Annual Meeting. Mr. Jappe was also appointed treasurer of the Development Fund.

On nomination of the President the Executive Committee of the Council was appointed to consist of the following members: James M. Todd, chairman, Frederick S. Blackall, Jr., Edgar J. Kates, Forrest Nagler, and Thomas E. Purcell.

Directors were assigned to the Boards and Committees of the Society, on nomination of the President, as follows:

Boards: Codes and Standards, Frederick S. Blackall, Jr.; Education and Professional Status, Ralph E. Sherman; Honors, J. N. Landis; Membership, J. A. Keeth; Public Affairs, J. B. Armitage; and Technology, Edgar J. Kates.

Committees: Finance, W. M. Sheehan, and H. V. Coes (reappointed for two years). Organization, A. L. Penniman, Jr., and E. G. Bailey (appointed for two years).

Committees Continued and Discharged

The following special committees of the Council are to be continued with the present personnel: Freeman Award; Gifts and Bequests; Junior; Lectureships; Metals Engineering Handbook; Nuclear Energy Application; Pension; Public Relations (with the addition of A. C. Pasini to the personnel), *Applied Mechanics Reviews*, Managing Committee, and Advisory Board.

The following special committees were discharged with sincere thanks and appreciation, their duties having been completed: ASME Committee on Organization of Engineering Profession; and Metal Cutting Data Committee.

It was voted to continue for one year the present policy under which all committee nominations are reviewed by the Organization Committee before submission to the Executive Committee of the Council.

It was voted to delegate for the period of one year specific functions to the Boards on Technology and on Codes and Standards.

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[1] Mechanical Engineer, Hazeltine Electronics Corporation, Little Neck, L. I., N. Y., Jun. ASME.

Engineers Promote Mobility of Ideas

THE South Texas Section of The American Society of Mechanical Engineers, with headquarters at Houston, Texas, is exploring how mechanical engineers working through their professional society can aid South Texas industry currently expanding at a rapid rate.

Looking for new avenues of service, the Section is seeking to give mobility to local ideas by sponsoring three conferences on subjects of interest to South Texas industry. A conference on gearing, one on design of casings, and a survey on the status of experimental stress analysis in the area are under consideration.

Section Activities

REPORTS of the following ASME Section Meetings were received recently at Headquarters:

Akron-Canton, Nov. 5. Inspection trip to plant of Firestone Tire and Rubber Company, Akron, Ohio. Attendance: 50.

Anthracite-Lehigh Valley, Oct. 22. Speaker: Capt. A. A. Nichoson. Attendance: 76.

Nov. 4. Annual smoker in which the Section acted as host to ASME Lehigh University and Lafayette College student branches. Speaker: Ralph Werner, Mem. SAE.

Baltimore, Nov. 22. Speaker: Albert L. Baker.

Boston, Nov. 18. Speaker: Col. F. M. Gunby. Attendance: 85.

Central Illinois, Oct. 13. Joint meeting with AWS, SAE, ASME, AIEE, ASTE, and AFS. Speaker: Earl Shreve.

Central Indiana, Nov. 19. Speaker: Everett C. Gosnell. Attendance: 81.

Chicago, Junior Group. Nov. 6. Inspection trip through Custom Molded Products Company. Attendance: 73.

Nov. 6. Woman's Auxiliary. Annual Husbands' Night, fall roundup. Attendance: 101.

Nov. 18. Speaker: Frank Kasmussen. Attendance: 47.

Cincinnati, Nov. 4. Speaker: E. A. Farmer. Attendance: 197.

Dayton, Nov. 17. Inspection trip to East Works of Armco Steel Corporation. Speaker: Ken McCutcheon. Attendance: 70.

Detroit, Nov. 17. Joint meeting with Engineering Society of Detroit. Speaker: Clyde E. Williams, Battelle Memorial Institute. Attendance: 625.

East Tennessee: Chattanooga Group, Nov. 12. Speaker: D. M. Marlowe. Attendance: 50.

Oak Ridge Group, Oct. 28. Color film: Operation Crossroads. Attendance: 30.

Louisville, Nov. 12. Speaker: F. A. Schmidt. Attendance: 21.

Metropolitan, Nov. 9. Speakers: Frank T. Barr, Harold V. Atwell, and Frank A. Howard.

Nov. 29. Speaker: Arvid E. Roach.

Milwaukee, Nov. 10. Speaker: A. C. Hagg. Attendance: 70.

Nebraska, Nov. 10. Speaker: Herbert C. Ulrich. Attendance: 56.

New Orleans, Oct. 19. Speaker: D. L. Chaney. Attendance: 55.

Nov. 17. Speaker: Waldemar S. Nelson. Attendance: 46.

Philadelphia, Nov. 23. Speaker: Robert J. Short. Attendance: 121.

Piedmont-North Carolina, Nov. 5. Speaker: Neil H. Brown. Attendance: 7.

Rochester, Oct. 14. Speaker: Wallace O. Fenn. Attendance: 57.

Rock River Valley, Oct. 21. Speaker: Robert Tait. Attendance: 63.

St. Joseph Valley, Nov. 16. Speaker: E. R. Ambrose. Attendance: 52.

San Francisco, Oct. 12. Speaker: E. G. Bailey, president ASME. Attendance: 150.

Savannah, Nov. 11. Speaker: Tom C. Earl. Attendance: 40.

South Texas, Nov. 15. Speaker: Monroe Shigley. Attendance: 130.

Southern California, Nov. 16. Speaker: Henry A. Babcock. Attendance: 44.

Southern Tier, Binghamton, Nov. 22. Subject: Electronics in Industry. Speaker: L. J. Murphy. Attendance: 35.

Virginia Section, Nov. 22. Joint meeting with Southwestern Virginia Engineers' Club. Slide lecture on future designs of railroad motive power by Charles Kerr, Jr. Attendance: 150.

Washington, D. C., Nov. 10. Smoker at Christian Heurich Brewery. Guests: E. G. Bailey, president ASME, and C. E. Davies, secretary ASME. Attendance: 222.

Western Washington, Nov. 3. Speaker: Col. Messick, U. S. Army Ordnance. Attendance: 225.

Wilmington, Nov. 17. Speaker: H. B. Maynard. Attendance: 100.

Worcester, Nov. 4. Speaker: B. P. Graves. Attendance: 50.

Youngstown, Nov. 11. Speaker: C. E. Davies, secretary ASME. Attendance: 73.

Student Branch Activities

Reports of the following ASME student branch meetings were received recently at Headquarters:

University of Akron, Nov. 18. Speaker: A. Oldham. Attendance: 42.

Alabama Polytechnic Institute, Nov. 1. Program: "Treasure From the Sea." Attendance: 86.

Nov. 15. Film on steam power for American seapower. Attendance: 97.

Nov. 29. Election of officers. Attendance: 52.

University of Arkansas, Oct. 20. First meeting of the season. Attendance: 80.

Nov. 1. Business meeting. Attendance: 35.

Brown University, Nov. 8. Inspection trip to H & B American Machine Company, Pawtucket, R. I. Attendance: 50

Catholic University, Nov. 18. Speaker: Jacob Rabinow. Attendance: 68.

Clemson College, Oct. 26. First meeting of the season. Attendance: 106.

University of Colorado, Nov. 4. Speaker: Lloyd E. Johnson. Attendance: 100.

Dec. 1. Speaker: T. A. Boyd. Attendance: 50.

Cooper Union (Day), Nov. 9. Two films shown. Attendance: 35.

Nov. 16. Speaker: A. C. Foulton. Attendance: 42.

Nov. 29. Speaker: Eric Hammerstein, Worthington Pump Co. Attendance: 84.

Cornell University, Nov. 9. Speaker: William Littlewood. Attendance: 163.

Nov. 16. Speaker: J. B. Reid. Attendance: 89.

Nov. 17. Tour of the Goulds Pump Company's plant at Seneca Falls, N. Y. Attendance: 25.

University of Delaware, Oct. 21. First meeting of the season. Attendance: 75.

Oct. 28. General meeting. Attendance: 75.

Nov. 30. I formal dinner. Guest of honor and speaker: Dr. Carlson, university president. Attendance: 51.

Drexel Institute, Nov. 3. Speaker: Miss Amy Corkum, Human Engineering Laboratories. Attendance: 31.

Duke University, Nov. 9. Film on nickel refining shown. Attendance: 35.

Nov. 23. Speaker: F. R. Wodtke. Attendance: 38.

University of Florida, Sept. 30. First meeting of the year. Attendance: 37.

Nov. 9. Joint meeting with Florida Engineering Section. Attendance: 100.

George Washington University, Nov. 3. Speaker: Frank Caldwell. Attendance: 60.

Illinois Institute of Technology, Nov. 9. Color sound movie on steam progress. Attendance: 275.

University of Illinois, Oct. 20. Speaker: R. R. Robinson. Attendance: 62.

Nov. 11. Speaker: G. A. Bowie. Attendance: 115.

Iowa State College, Nov. 16. Speaker: Prof. Lawrence R. Hillyard. Attendance: 102.

State University of Iowa, Nov. 3. Film on production of steam boilers.

Nov. 10. Speaker: Professor Thorton of SUI history department.

Kansas State College, Nov. 4. Speaker: Prof. Leland Hobson. Attendance: 150.

Nov. 18. General business meeting. Attendance: 155.

University of Kansas, Oct. 19. Speaker: E. G. Bailey, president ASME. Attendance: 202.

Oct. 28. Speaker: W. Mooney. Attendance: 62.

Nov. 11. Joint meeting with student branch ASME, Kansas University. Speakers: Miss Pat Siwan and Prof. Fred L. Parrish. Attendance: 140.

University of Kentucky, Oct. 28. Speaker: Professor Carter.

Oct. 21. Tour of plants of Henry Vogt Machine Company and Reynolds Metal Company, Louisville, Ky. Attendance: 84.

Lafayette College, Nov. 4. Annual smoker given by Anthracite-Lehigh Valley Section to ASME student branches of Lehigh University and Lafayette College.

Lehigh University, Nov. 4. Annual smoker given by Anthracite-Lehigh Valley Section to

SOUTH DAKOTA STATE COLLEGE BRANCH HUNTS UP A DINNER

(After the shooting was over, Nov. 6, members of the ASME Student Branch South Dakota State College, took a short breather and dashed back to attend a pheasant dinner in conjunction with their regular biweekly meeting, Nov. 17. *Front row:* K. Leslie, L. Edwards, C. Puder, J. Landes, C. Besselson. *Rear:* S. Bol, R. Zieske, K. Wetterburg, R. Bly, R. Day, Student Branch Pres., P. Anderson, F. Albertus, and Prof. L. L. Amidon, honorary chairman.)

ASME student branches of Lehigh University and Lafayette College.

Louisiana State University, Oct. 26. Speaker: Dr. Keen. Attendance: 89.

Nov. 9. Speaker: Dr. J. N. Efferson. Attendance: 77.

University of Maine, Nov. 16. Speaker: E. L. Dahland. Attendance: 82.

Massachusetts Institute of Technology, Oct. 18. Speaker: Professor Hrones. Attendance: 220.

Nov. 8. Speaker: Prof. Erwin Schell. Attendance: 125.

Michigan State College, Nov. 3. Speaker: J. J. Edwards. Attendance: 42.

Nov. 17. Speaker: Dr. Ernest J. Abbott. Attendance: 55.

Michigan College of Min. and Tech., Nov. 9. Film on Quality Control in the Manufacture of Copper Tubing. Attendance: 83.

University of Michigan, Oct. 27. Program of three films. Attendance: 180.

Nov. 10. Speaker: R. O. Fehr. Attendance: 92.

Nov. 15–18. Field trip to Diesel Engine Division, General Motors Corporation plant. Attendance: 128.

Mississippi State College, Oct. 26. Speaker: Mr. Ward. Attendance: 30.

Nov. 4. Two films on gear generation. Attendance: 45.

Missouri School of Mines, Nov. 9. Speaker: J. F. Myers. Attendance: 105.

University of Nebraska, Oct. 20. Speaker: Lewis E. Harris. Attendance: 147.

Nov. 3. Speaker: H. D. Sanborn. Attendance: 118.

Nov. 17. Speaker: Frederick J. Ludwig. Attendance: 180.

Newark College of Engineering, Nov. 15. Speaker: Capt. William Lott, U. S. Air Force. Attendance: 92.

University of New Hampshire, Nov. 17. Speakers: I. T. Hook, and Erwin Dahlund. Attendance: 54.

New Mexico State College of A and M Arts Nov. 1. Speaker: Capt. E. B. Dechemendy. Attendance: 40.

Nov. 18. Film showng streamlined steel production. Attendance: 60.

University of New Mexico, Oct. 26. Third meeting of the season. Attendance: 50.

North Dakota Agricultural College, Dec. 1. Inspection trip to American Crystal Sugar Company, Moorhead, Minn. Attendance: 45.

University of North Dakota, Oct. 13. Showing of film on steam progress. Attendance: 22.

Oct. 25. Field trip to American Crystal Sugar Company's refinery. Attendance: 22.

Nov. 2. General meeting. Attendance: 20.

University of Notre Dame, Nov. 11. Film entitled "Magazine Magic." Attendance: 50.

Nov. 23. Speaker: Prof. James A. Tankersley. Attendance: 61.

Ohio State University, Dec. 2. Speaker: Frank Fletcher. Attendance: 156.

Oklahoma A and M College, Nov. 11. Joint meeting with student branch of AIEE. Speaker: Maynard M. Boring.. Attendance: 285.

Nov. 22. Speaker: W. S. Burns. Attendance: 80.

Oregon State College, Oct. 14. Speaker: John Foster. Attendance: 43.

Oct. 30. Speaker: Col. B. S. Messick, U. S. Army Ordnance. Attendance: 200.

Pennsylvania State Collge, Nov. 9. Joint meeting with other engineering societies on the campus. Speaker: Charles S. Wyand. Attendance: 60.

University of Pennsylvania, Nov. 2. Speaker: Mr. Putz. Showing of two films. Attendance: 57.

Polytechnic Institute of Brooklyn (Evening), Oct. 4. Speakers: E. L. Midgette, head of mechanical-engineering department, and A. R. Mumford, vice-president, ASME Region II.

Nov. 8. Showing of two technical films. Attendance: 47.

Nov. 23. Speaker: A. R. Mumford, vice-president, ASME Region II. Attendance: 126.

Pratt Institute, Nov. 19. Business meeting. Attendance: 35.

Princeton University, Oct. 25. Speaker: R. P. Johnson. Attendance: 27.

Nov. 22. General business meeting. Attendance: 21.

Queen's University, Kingston, Ont., Can., Nov. 11. Film shown on Diesel engines. Attendance: 75.

Rice Institute, Oct. 29. Trip to Humble Oil Company's refinery, Baytown, Texas.

University of Rochester, Nov. 18. Speaker: Dr. Gibbons, N.A.C.N. laboratory. Attendance: 52.

Dec. 2. Speaker: Mr. Cooly. Attendance: 14.

South Dakota State College, Nov. 3. Speaker: Paul McLaughlin. Attendance: 45.

Nov. 17. Film on Steam Progress. Attendance: 50.

University of Southern California, Oct. 22. Speaker: J. Calvin Brown, vice-president, ASME Region VII. Attendance: 64.

Stanford University; Nov. 9. Speaker: S. Timoshenko. Attendance: 31.

Swarthmore College, Nov. 23. Election of officers. Attendance: 25.

University of Tennessee, Nov. 10. Speaker: Charles H. Everett. Attendance: 35.

Nov. 17. Joint meeting with AIChE branch. Speaker: M. E. Merchant.

Tufts College, Nov. 16. Showing of a film from W. H. Nichols Co. of Waltham, Mass. Attendance: 40.

Texas A and M College, Nov. 17. Speaker: Austin Weir. Attendance: 108.

U. S. Naval Academy (Midshipman School), Oct. 13. Speaker: Francis G. Tatnall.

Oct. 20. Film "Railroadin," American Locomotive Company.

Virginia Polytechnic Institute, Nov. 30. General meeting. Attendance: 195.

Washington University, Oct. 7. Speakers: Dean Stout and Professor Newton. Attendance: 40.

Nov. 1. Speaker: J. Culling. Attendance: 64.

University of Washington, Oct. 14. Showing of two films. Attendance: 60.

Nov. 4. Film on streamlined steel. Attendance: 30.

Nov. 17. Speaker: Mr. Grant, Ethyl Corporation. Attendance: 87.

Wayne University, Nov. 4. Speaker: Oliver K. Kelly. Attendance: 91.

University of Wisconsin, Nov. 23. Speaker: Richard E. Sullivan. Attendance: 50.

Worcester Polytechnic Institute, Dec. 6. Speaker: J. H. Hitchcock. Movie on making and shaping of steel.

University of Wyoming, Oct. 26. Film on atomic power shown. Attendance: 31.

Yale University, Oct. 27. Speaker: John G. Lee. Attendance: 52.

Nov. 17. Speaker: Charles Kirchner. Attendance: 72.

ASME Sections

Coming Meetings

Anthracite-Lehigh Valley: January 28. Bethlehem Meeting. Subject: Stress-coat and Related Experimental Stress-Analysis Methods. Speaker to be announced.

Atlanta: January 10. YMCA Dining Room at 12:30 p.m. Luncheon Meeting. Subject: Dust Control, by John M. Kene, American Air Filter, Louisville, Ky.

Boston: January 27. Section Meeting. Subject: A Research and Development Laboratory for Aircraft Gas Turbines, by M. C. Hensworth, General Electric Company.

Central Indiana: January 21. Dinner at Cafeteria of the South Wind Plant; Stewart Warner Corporation, Indianapolis, Ind., at 6:30 p.m., Meeting at 8 p.m. Subject: Automobile, Home and Aircraft Heaters, by F. A. Ryder, chief engineer, South Wind Division, Stewart Warner Corporation, Indianapolis, Ind. Plant Inspection with invitation to Rose Polytechnic Institute.

Hartford: January 18. City Club at 6:30 p.m. Subject: Operating the Furnace of an Internal-Combustion Engine, by A. Lewis MacClain, liaison engineer, P & WA.

Metropolitan Section: January 4. Industrial Instruments and Regulators Division, Room 1101[1] at 7:30 p.m. Subject: Evaluating Servomechanism Performance, by George M. Attura, Servomechanisms Inc.

January 11. Power Divison, Auditorium,[1] at 7:30 p.m. Subject: Latest Experiences With Cyclone Furnaces, by F. G. Ely, research engineer, G. A. Watts, staff engineer, Babcock & Wilcox Co.

January 13. Woman's Auxiliary, Room 1101[1] at 2:30 p.m. Subject: From a Newspaper Reporter, by R. A. Dougherty of the New York Herald Tribune.

January 13. Junior Group, Room 502[1] at 7:30 p.m. Subject: Bringing the Junior Engineer Up to Date on His Economic Status. Speakers from Management, Personnel Services, Organized Engineering Employee Associations, and Technical Societies.

January 18. Materials Handling Forum, Room 502[1] at 7:30 p.m. Subject: Moving Stairways, by Carl J. Kroepel, AIA, Otis Elevator Co.

January 20. Photographic Group, Room 1101[1] at 7:30 p.m. Subject: What's New in Enlargers, by the Simmon brothers, Simmon Bros., Inc.

January 25. General Interest Meeting, Room 501[1] at 7:30 p.m. Subject: Incentive—Key to American Economy, by J. F. Lincoln, President Lincoln Electric Co., and L. M. Greene, investment counsel.

Minnesota: January 5. Inspection Trip. Being arranged.

Ontario: January 13. Music Room, Hart House at 8 p.m. Subject: To be announced. Speaker: Tracy LeMay, Toronto Civic Planning Board.

Philadelphia: January 18. Towne School, University of Pennsylvania at 8 p.m. Subject: New Heat-Transfer Developments, by Dr. Allen P. Colburn, head, chemical engineering department, University of Delaware, Newark, Del.

January 25. Joint Meeting with Engineers Club. Subject: The Value of Professional Engineering Societies to the Engineer, by William F. Ryan, engineering manager, Stone and Webster Engineering Corporation, Boston, Mass.

Plainfield: January 19. Elk's Club, Elizabeth, N. J. at 8:15 p.m. Subject: Making Structures by Making Them Lighter, by Francis G. Tatnall, Baldwin Locomotive Works.

Southern California: January 5. California Institute of Technology, Pasadena, Calif. Subject: Drafting Standards for Piping Drawings, by Anthony Hunter.

January 11. Minneapolis Honeywell Building, 2840 East Olympic Boulevard, Los Angeles. Subject: Vegetable Oil Processing, by Clay C. Hopper.

January 12. Room 125, Chemical Building, UCLA. Subject: Heat Transfer in Suppression of Wood Fires, by George J. Tauxe.

January 12. University of Southern California. Subject: Bearing Applications, by Frank W. Pollard. Machine Design Division Meeting.

January 12. Southern California Edison Building, 601 West 5th Street, Los Angeles. Subject: Mechanical Transients, by Dr. D. E. Hudson. Applied Mechanics Division Meeting.

January 12. Southern California Edison Building, 601 West 5th Street, Los Angeles. Subject: Plans for 1949, by J. S. Earhart. Professional Division Meeting.

January 12. Southern California Edison Building, 601 West 5th Street, Los Angeles. Subject: Delegation of Authority and Responsibility, by E. Favary. Management Division Meeting.

January 12. California Institute of Technology, Pasadena. Subject: Pumps, by Perry Brown and Paul Armstrong. Hydraulics Division Meeting.

January 19. Southern California Edison Building, 601 West 5th Street, Los Angeles. Subject: Oil Refinery Instrumentation, by Nort Wolfe. California Institute of Technology, Pasadena. Subject: Industrial Piping, by Albert Wood.

January 21. Kaiser Steel, Fontana, Calif. Dinner at 6:30 p.m. Trip through steel and pipe mills.

January 26. California Institute of Technology, Pasadena. Subject: Hydroelectric Plants, by Walter Cates. Southern California Edison Building, 601 West 5th Street, Los Angeles. Subject: Feedwater regulation, by M. Magenthauler.

January 27. Rexall Square, Beverly and LaCienega. Dinner at 6:30 p.m. General Meeting. Subject: Lapping to one millionth, by Ray G. Roshong.

San Diego Sub-Section: January 19. San Diego Women's Club. General Meeting. Open Forum.

January 26. Solar Aircraft Corporation Plant-Field Trip. Speaker: E. R. Prout.

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[1] Engineering Societies Building, New York, N. Y.

Keep Your ASME Records Up to Date

HEADQUARTERS depends on its master membership file for answers to hundreds of inquiries daily pertaining to its members. All other Society records and files are kept up to date through changes processed through it. The listings in future ASME Membership Lists will be taken directly from the master file. It is important to you that it lists your latest mailing address and your current business connection.

The mailing form on this page is published for your convenience. You are urged to use it in reporting recent changes.

Your mailing address is important to Headquarters. Please check whether you want your mail sent to home or office address.

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Home Address .... ☐
Street City Zone State

Name of Employer ....

Address of Employer .... ☐
Street City Zone State

Product or Service ....

Position or Title ....

Notify Headquarters Promptly of Changes

Engineering Societies Personnel Service, Inc.

These items are from information furnished by the Engineering Societies Personnel Service, Inc., which is under the joint management of the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to members and is operated on a co-operative nonprofit basis. In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrants whose notices are placed in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office. When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available to members of the co-operating societies at a subscription of $3.50 per quarter or $12 per annum, payable in advance.

New York
8 West 40th St.

Chicago
84 East Randolph Street

Detroit
109 Farnsworth Ave.

San Francisco
57 Post Street

MEN AVAILABLE[1]

Mechanical Engineer, 35, BSME, N. Y. and N. J., PE, married, eight years diversified plant engineering, consisting of design, construction, and maintenance of powerhouse, industrial process heating, and plant utilities. Desires position as chief or plant engineer. Me-360.

Engineer, Production, 37, married, with twenty years' experience from apprentice tool making, tool design, production engineering, supervisor of design, plant layout, toolroom and maintenance. Northwest. Me-361-4810-D-16.

Factory Executive, MSME, PE, also cost accountant. Twenty-two years' manufacturing experience, including production supervision and planning, sales forecasts, budgets, and cost reduction through improved methods and product redesign. Me-362.

Mechanical Engineer, 27, married, BS ME, 1947. Eighteen months project-development engineer, 36 months engineering officer, U.S.N.R. Desires position with engineering firm or industry in New York, N. Y., area. Available Jan. 1. Me-363.

Public Relations Representative with seven years in active promotion of aircraft and heavy industrial equipment by magazine, newspaper writing, lecturing societies, industrial and civic groups, conducting plant tours, trade displays, ad agency liaison. European representative, U. S. manufacturer. Government service searching. German plants after war. Me-364.

Mechanical Engineer, 34, PE; ME Cornell University, two years' graduate work M.I.T. Eleven years' experience research, development. Desires technical staff position well-established research department. Presently employed. Prefers metropolitan New York or southwestern Connecticut, but will relocate. Me-365.

Plant Manager, 48, graduate ME. Mechanical equipment such as power plant, printing, pulp and paper field. Prefer Chicago area, but will go elsewhere. Me-366.

Production Engineer, 29. Honor graduate. New superintendent of plant manufacturing automatic machinery. Seven years' designing, tooling, and production experience; skilled in administration, organization, and cost control. Locate anywhere, prefers Southwest. Me-367-15-M.

Recent Graduate desires position which offers future with responsibility, difficult work, and opportunity for advancement. No experience in any engineering field. Me-368.

Mechanical Engineer, BSME, 29, married. Five years' diversified experience. Desires position in development or consulting work. Prefers Kansas City industrial area. Me-369.

Mechanical Engineer, BSME, MSME. Over twenty years' experience in industry and engineering education, including chief engineer, assistant to president, and professor of mechanical engineering. Me-370.

Graduate Mechanical Engineer, 28, single, with experience in maintenance, safety, and elementary structural and mechanical design. Can work smoothly with all levels of personnel. Presently employed, but desires work in South America, with U. S. firm. Me-371.

POSITIONS AVAILABLE

Engineers. (*b*) Piping-design engineer, 30–45, mechanical graduate, with at least five years' experience in piping design (heavy industry). Experience in pulp and paper industry preferred. Majority of time will be spent in investigating conditions that exist in the manufacturing plants; taking measurements necessary, making complete plans and specifications as to piping changes and types of pumping equipment. $5000. (*c*) Mechanical engineer, 30–45, mechanical graduate, with at least 5 years' experience layout and design in heavy industry. This experience preferably in pulp and paper industry. Will do apparatus, building layout, and design work on machines, wasters, tanks, conveyers, etc. Must be able to arrange and install this equipment. Will do some field work and some structural steel work. About $5000. New England. Y-1794.

Engineers. (*a*) Production engineer, 30 38, mechanical graduate, with considerable machine-shop production and parts-assembly experience, to supervise metal-products fabrication. (*b*) Methods engineer, 30–38, mechanical graduate, with methods and production experience, to take charge of methods department for accessories manufacturer. $6000-$7000. Midwest. Y-1806-R-5365.

Salesman, 27–43, with successful sales record and experience selling steam specialties or kindred equipment. Atlanta territory, leading manufacturer valves, gages, instruments. Salary plus expenses. Y-1809.

Mechanical Engineer, 30-40, with elevator experience, to design and lay out elevator equipment and installations. $5000-$6000. New York metropolitan area. Y-1812.

Salesman, mechanical graduate, with about five years' experience in the combustion or the instrument department of a steel mill, for sales in the Chicago steel-mill district. Salary to start, $4800. Y-1816.

Mechanical Engineer, familiar with industrial-plant maintenance and equipment, for contracting firm. Should be able to estimate millwright work and iron work and take off construction quantities. $5200. New York, N. Y. Y-1829.

Mechanical Engineer with at least ten years' machinery and equipment-design experience, to conceive ideas, design and detail improvements on aluminum-foil and paper-processing machinery. $6000–$8000 Suburban New York area. Y-1841.

Power Superintendent, 35–45, mechanical graduate, with at least ten years' supervisory experience, covering industrial steam-power plant, to supervise steam generation and power distribution in paper mill. $6000. North Carolina. Y-1842.

Mechanical Engineer, graduate, with several years' experience in automotive internal-combustion-engine design, test, and development, either in connection with test and development of the engine itself or its transmissions or other power devices, to perform the experimental design, development, and test work on marine-engine transmissions. $5000-$6000, depending on qualifications. Massachusetts. Y-1866.

Assistant to Plant Superintendent in charge of maintenance, mechanical degree, for large manufacturer in food industry. Should have at least ten years' experience in automatic equipment, particularly electromechanical automatic devices. $5600–$6000. New York, N. Y. Y-1874.

General Sales Manager, 35–45, mechanical graduate, with at least ten years' instrument and control sales experience, including five years of sales-management experience, to take charge of sales program covering flowmeters, recorders, etc. $6000, plus bonus. East. Y-1877.

Teaching Personnel. (*a*) Assistant professor with degree in industrial engineering and some teaching experience, to teach industrial-engineering subjects and some engineering drawing. Sufficient industrial experience will be considered in lieu of teaching experience. $3400 for nine months with summer school on the basis of $600 for six weeks. (*b*) Instruc-

(*ASME News continued on page 118*)

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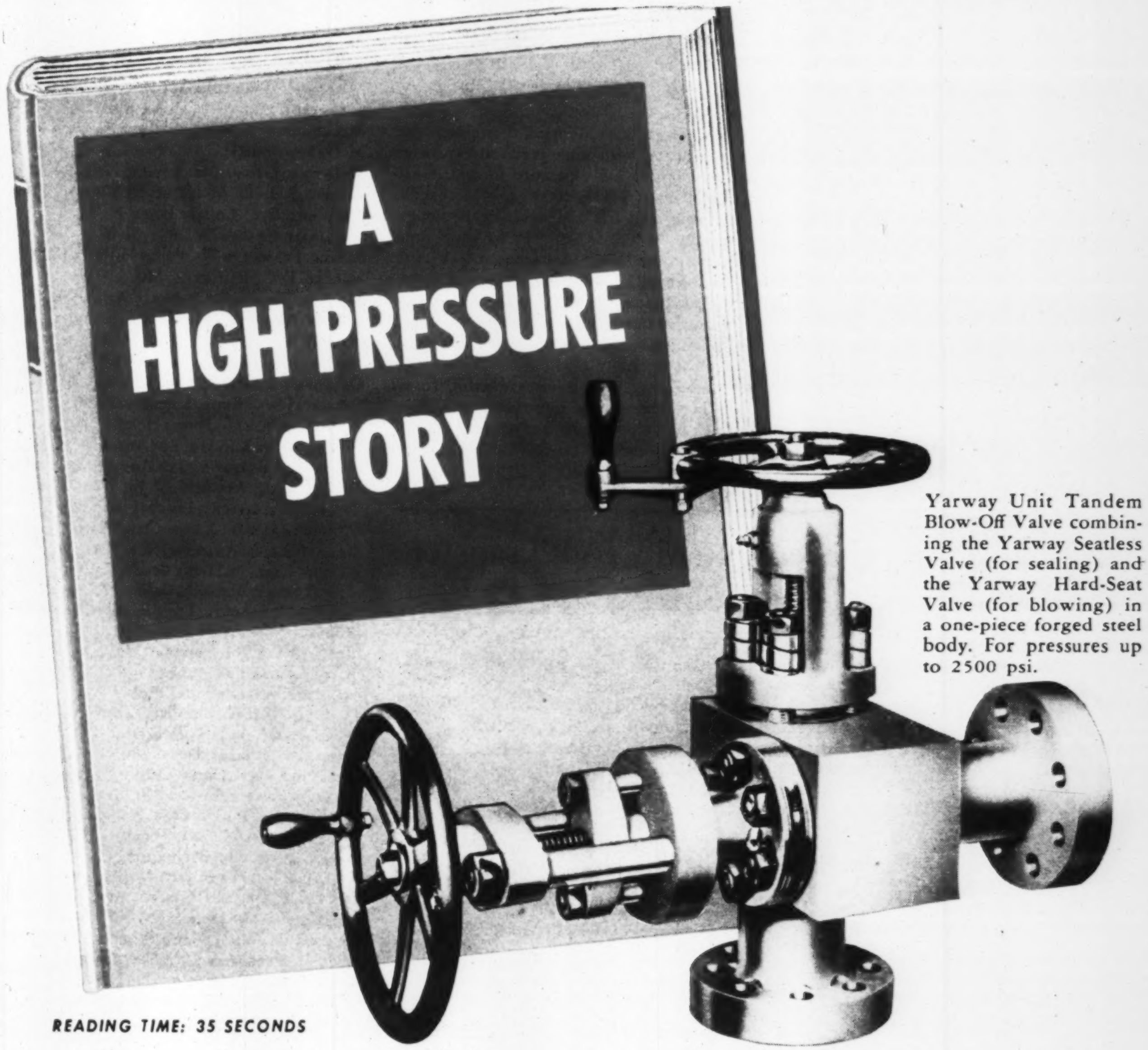
[1] All men listed hold some form of ASME membership.



Yarway Unit Tandem Blow-Off Valve combining the Yarway Seatless Valve (for sealing) and the Yarway Hard-Seat Valve (for blowing) in a one-piece forged steel body. For pressures up to 2500 psi.

READING TIME: 35 SECONDS

Not once-upon-a-time, but *today*, there is a certain valve that is giving such outstanding satisfaction in boiler blow-down service, that more than four out of every five high pressure boiler plants in the United States use it. That blow-off valve is the Yarway.

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Yarway's famous Seatless Valves have no seat to score, wear, clog and leak. And Yarway Hard Seat Valves, especially suited for high pressure service, have special stellited seats and discs.

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MORAL—For the best in blow-down service, buy Yarway blow-off valves. Completely described in Bulletin B-432. It's free. Write . . .

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YARWAY BLOW-OFF VALVES

tors, graduates, with industrial-engineering degree, to teach industrial-engineering subjects, including engineering drawing and descriptive geometry. $2600 for nine months plus summer term at about $500. Texas. Y-1880-S.

Mechanical Engineer with particular experience in maintenance, preferably of large retail stores, and with some background of construction. Will act as liaison between owner and contractor and architect. Later, complete charge of maintenance. $6000–$7000. New York, N. Y. Y-1883.

Mechanical Engineer with at least five years' experience covering design and operation of aluminum-forging plant, to make survey of metallurgical plants, estimate improvements, and plan new production. $6000–$8000. Headquarters, New York, N. Y. Y-1888-C-D.

Engineers. (*a*) Mechanical engineer, 30–40, graduate, with some practical experience in hydraulics, and especially in centrifugal-pump design. $4800–$6000. (*b*) Mechanical draftsman who has had structural design experience. $3120–$3380. Prefer applicants located in the East. Massachusetts. Y-1892.

Industrial Engineer with general inventory, purchasing, shipping, and accounting experience, to supervise material, equipment, and other controls for oil company. Salary open. South America. Y-1894.

Mechanical Engineers, graduates, to act as field engineers in the construction of a power plant. Must have had five to ten years' experience in this line. $5000–$6000. Long Island, N. Y. Y-1896(a).

Candidates for Membership and Transfer in the ASME

THE application of each of the candidates listed below is to be voted on after January 25, 1949, provided no objection thereto is made before that date, and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the secretary of The American Society of Mechanical Engineers immediately.

KEY TO ABBREVIATIONS

Re = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member.

NEW APPLICATIONS

For Member, Associate, or Junior

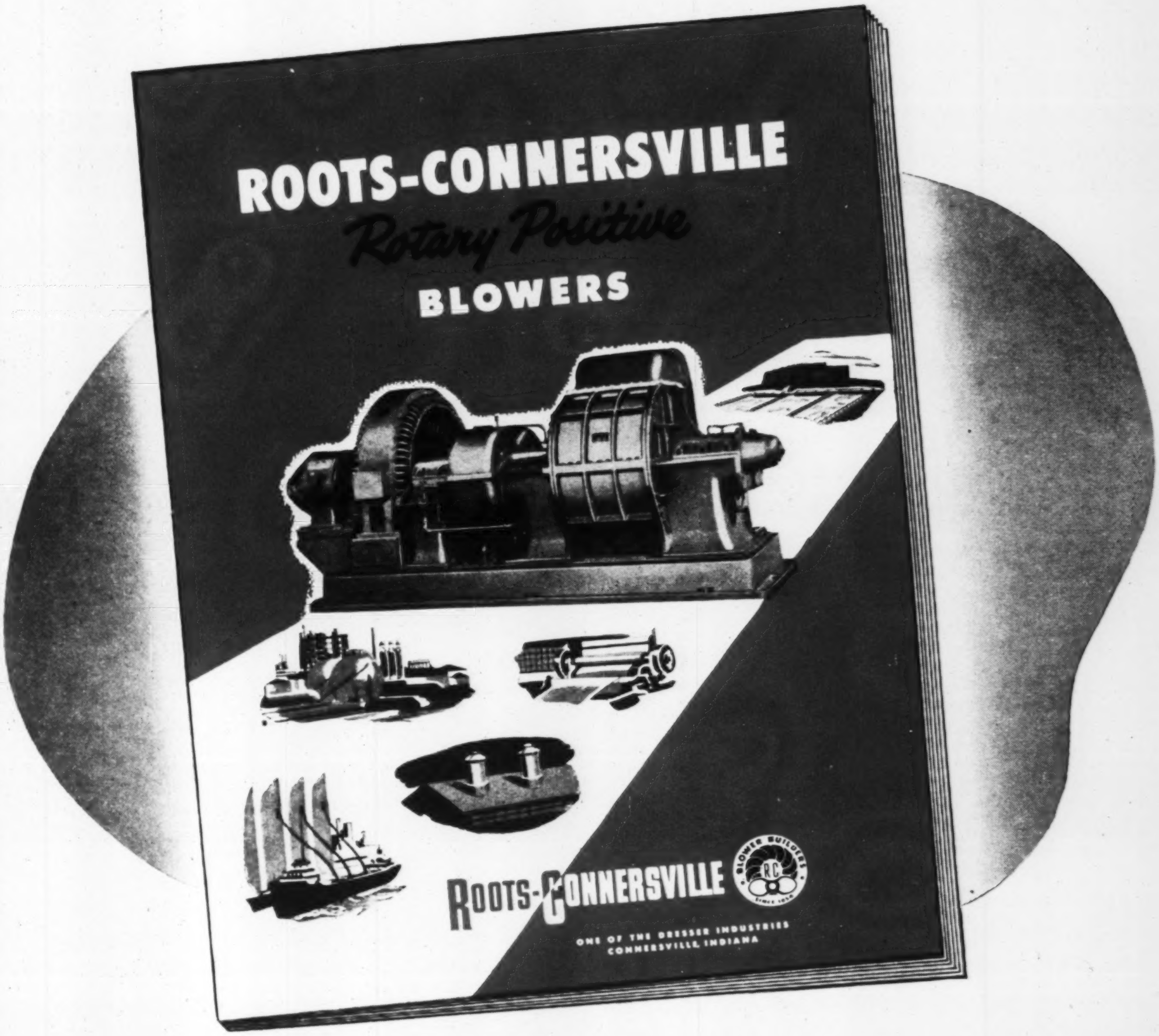
Ackerman, Edw. J., Belleville, N. J.
Ahmad, Mukhtar, Aligarh, India
Aubertin, Howard A., Worcester, Mass.
Barkenthien, F. H., Arcadia, Calif.
Bayer, Charles H., Wynnewood, Pa.
Beauchamp, W. G., Rutherglen, Scotland
Beck, Henry Charles, New York, N. Y.
Beede, Stephen M., Jr., Downey, Calif.
Berchtold, Max, Morrisville, Pa.
Bernard, G. Ross, Huntington Park, Calif.
Boyce, Carroll W., Valley Stream, N. Y.
Braglio, Chas., New Kensington, Pa.
Breault, J. Louis, Jr., Oro Grande, Calif.
Breckenridge, James H., York, Pa.
Brown, John Wesley, Jr., Lakewood, Ohio
Butler, Harry Reese, Los Angeles, Calif.
Cates, Walter H., Pasadena, Calif.
Chaszeyka, Michael A., Brookfield, Ill.
Christensen, Lyle A., Kansas City, Mo.
Colley, Joseph F., Savannah, Ga.
Collison, J. G., Greensboro, N. C.
Connor, Thomas Cotter, Detroit, Mich.
Corsiglia, John, Columbus, Ohio
Crouch, Harold C., Newark, N. Y.
Dahl, Osborne H., Long Beach, Calif.
Danziger, Charles, Brooklyn, N. Y.
Dempster, Malcolm R., Richland, Wash.
Dickinson, W. F., Los Angeles, Calif.
Doty, Robert O., Los Angeles, Calif.
Dulkin, Henry H., Chicago, Ill.
Ebersole, George Blaine, Westfield, N. J.
Edward, Harrison F., North Tarrytown, N. Y.
Evans, Lewis M., Syracuse, N. Y.
Faler, John A., Farmington, Mich.
Fallon, C. T., Los Angeles, Calif.
Freeman, Newell L., Schenectady, N. Y.
Goble, George H., Haddon Heights, N. J.
Gross, Frank A., Jr., River Edge, N. J.
Guiney, Francis Michael, Floral Park, N. Y.
Habjan, Ladislaus J., Cleveland, Ohio
Hanes, Dean, Los Angeles, Calif.
Harnar, Robert R., Cleveland, Ohio
Harris, Herbert R., Flushing, N. Y.
Harrison, James R., Los Alamos, N. M.
Hayden, Herbert L., Upper Montclair, N. J.
Hellman, Paul, Los Angeles, Calif.
Henry, Herman L., Jr., Ruston, La.
Hepburn, Earle H., Burbank, Calif.
Hill, Frank A., Seattle, Wash.
Hill, Harvey T., Chicago, Ill.
Hixenbaugh, Paul E., Akron, Ohio
Hohnholt, Frank F., Tenafly, N. J.
Hoke, Rufus Wikoff, Los Angeles, Calif.
Ismail, A. Sultan, Dokki, Cairo, Egypt
James, Earle F., Lynwood, Calif.
Jones, W. Lawson, Pasadena, Calif.
Kececioglu, Dimitri V., W. Lafayette, Ind.
Kessler, George W., Bronx, New York, N. Y.
Kluge, Friedrich Hugo, Olean, N. Y.
Krishnaswamy, Sarangan, Chintadriprt, Madras, India
Krueger, Ralph Norton, Santa Monica, Calif.
Krummell, John Douthett, La Grange Pk., Ill.
Kulka, William, Chiswick, London, England
Lackler, John L., Takoma Park, Md.
Laidrich, Edward, Los Angeles, Calif.
Larrecq, A. J., New Hope, Pa.
Lazarus, Morton S., Highland Park, N. J.
Leader, Francis M., Spring Grove, York County, Pa.
Lee, Harry A., Richland, Wash.
Low, Wallace F., Beaver Falls, Pa.
Lowd, Judson D., Tulsa, Okla.
Lowrie, Jack Templeton, Hoboken, N. J.
MacCrehan, W. A., Jr., New York, N. Y.
Mandonsa, Louis William, Sacramento, Calif
Maybarduk, Leon A., Sunnyside, N. Y.
McDonough, John T., Dunkirk, N. Y.
McGarry, John F., Mt. Vernon, N. Y.
McIntosh, George, Hicksville, N. Y.
Meditz, John E., Malverne, N. Y.
Mehnert, E. S., College Point, N. Y.
Meldram, Charles W., Rye, N. Y.
Meyer, Franklyn W., Forest Hills, L. I., N. Y.
Miller, F. C., Baltimore, Md.
Muller, John Thomas, North Arlington, N. J.
Narciso, Francisco M., West Allis, Wis.
Naulty, Charles J., Whittier, Calif.
Nearn, William T., State College, Pa.
Orlebeke, Howard Peter, Chicago, Ill.
Palomo, Oscar Kene, Schenectady, N. Y.
Paul, Carlton H., Peoria Heights, Ill.
Phelps, Peter Martin, Los Angeles, Calif.
Phillippi, Charles A., Los Angeles, Calif.
Pitt, Samuel, Westfield, N. J.
Puglisi, William R., Los Angeles, Calif.
Reed, Forrest B., Kansas City, Mo.
Reed, William Andrew, New York, N. Y.
Rettig, Carl, Jr., Long Beach, Calif.
Rios, Robert, Burbank, Calif.
Ritchey, Randolph, Long Beach, Calif.
Robison, Walter O., Philadelphia, Pa.
Rogers, H. S., Brooklyn, N. Y.
Rothermel, Ulla A., New York, N. Y.
Rudolph, Robert Paul, York, Pa.
Ryan, Robert C., Cleveland, Ohio
Sandberg, Carl I., Glen Ellyn, Ill.
Schilling, Robert, Detroit, Mich.
Selander, Carl Oscar, Denver, Col.
Sharafanowich, Edward S., New York, N. Y.
Shelvik, Bertrum Sivert, Milwaukee, Wis.
Shvetz, Roman E., New York, N. Y.
Sidle, Robert G., Burlington, Vt.
Smith, P. A., Long Beach, Calif.
St. Cin, George E., Chattanooga, Tenn.
Steen, Hans F., Jamaica, N. Y.
Stevenson, Wm. H., 3rd, Winston-Salem, N.C.
Straub, Frederick Guy, Champaign, Ill.
Stubbart, Ira G., Cleveland Heights, Ohio
Surie, A. D., Cleveland, Ohio
Tapp, John G., San Gabriel, Calif.
Theilhaber, Joachim Thola, Forest Hills, L. I., N. Y.
Thompson, H. C., Jr., W. Lafayette, Ind.
Tone, Frederick F., Holley, N. Y.
Traylen, George James, Venezuela, South America
Turunen, William A., Detroit, Mich.
Urbina, Daniel S., Long Beach, Calif.
Vandekieft, Nicholas, Chicago, Ill.
Vanderploeg, Elmer John, Cleveland, Ohio
Vogel, Harry, New York, N. Y.
Vogelsang, Hans, Oil City, Pa.
Walter, Paul R., E. Orange, N. J.
Warshaw, Sidney G., New York, N. Y.
Welch, Harry Jay, Milwaukee, Wis.
Werner, Harry Carl, Buffalo, N. Y.
Westbrook, Adrian J., Dayton, Ohio.
Winans, R. H., Houston, Tex.
Winters, James Floyd, Dallastown, Pa.
Wood, Frederick H., Toledo, Ohio
Wood, George W., York, Pa.
Woodrow, Wallace H., Springfield, Mass.
Zust, Charles M., New York, N. Y.

CHANGE IN GRADING

Transfer to Member

Bascom, Joseph H., St. Louis, Mo.

(*ASME News continued on page 120*)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